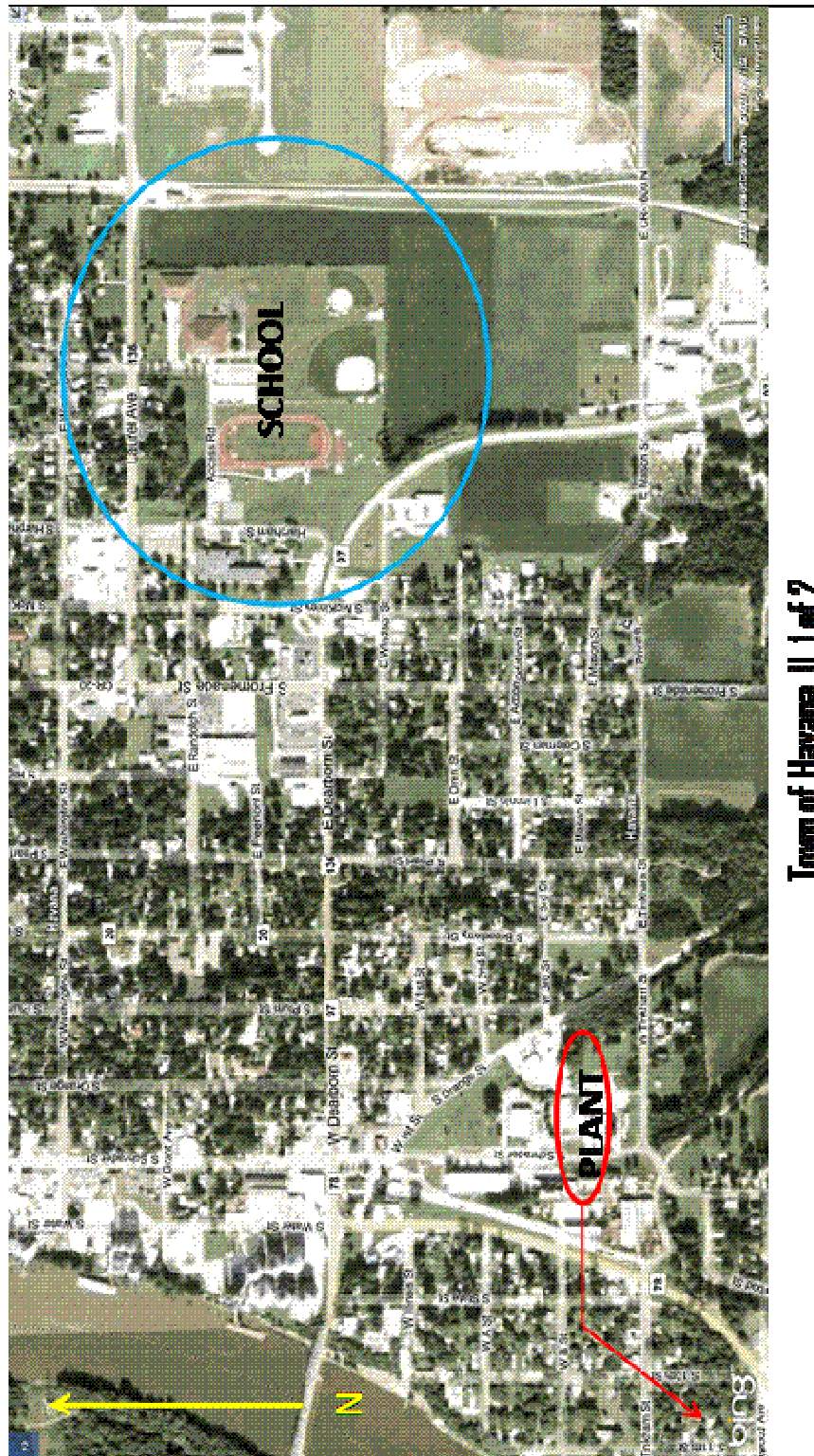


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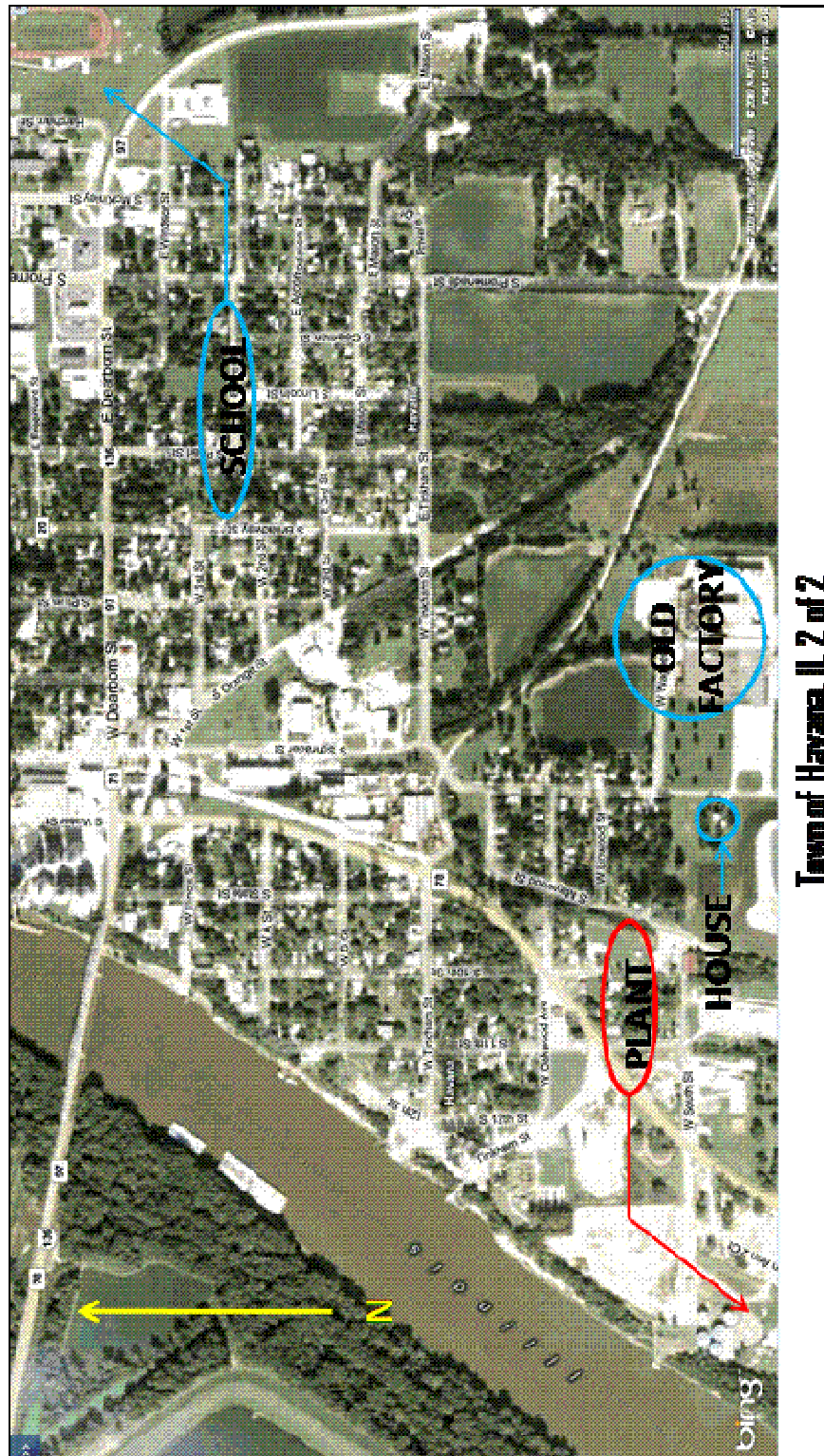


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Town of Havana, IL 1 of 2

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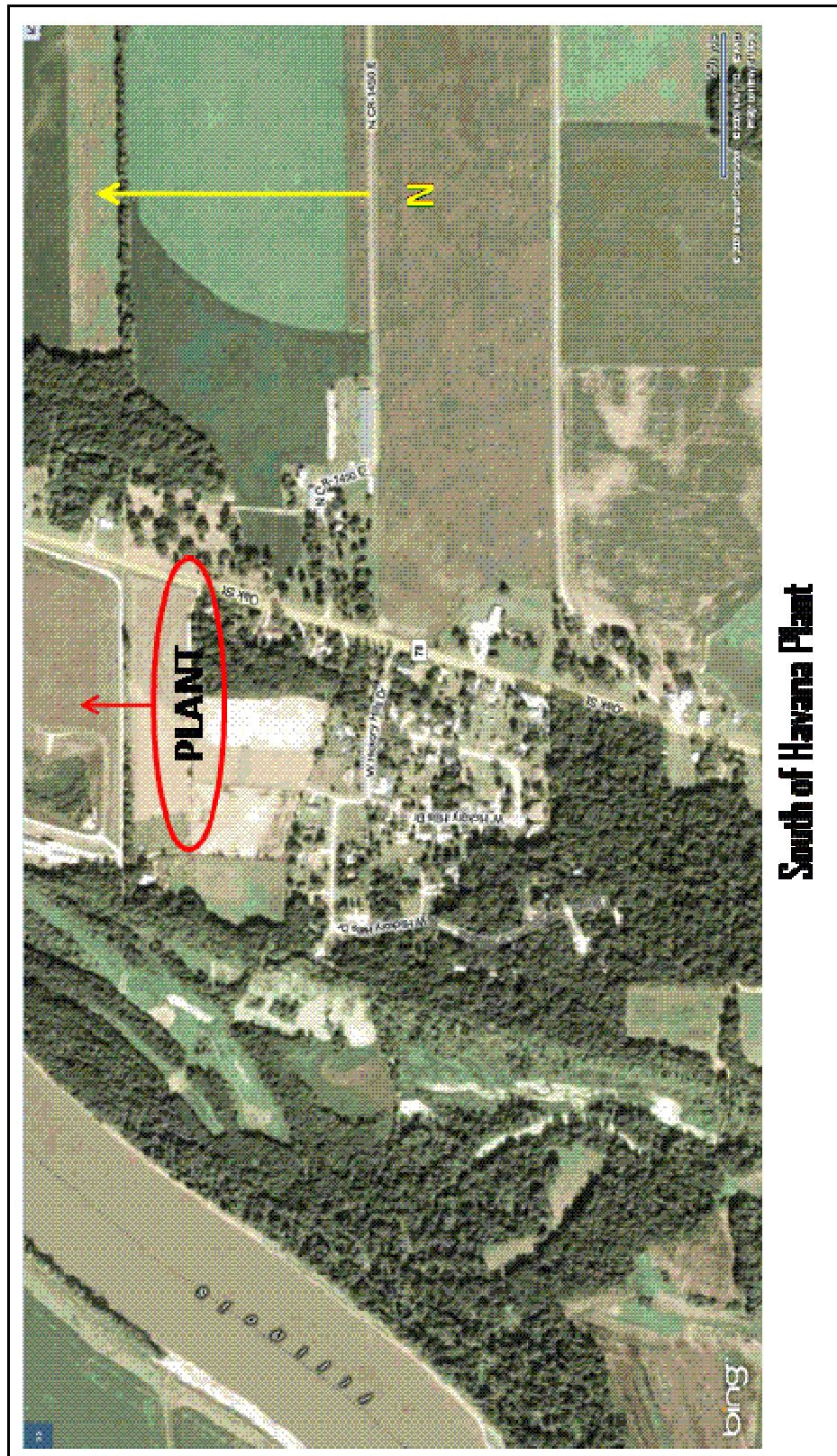
Town of Havana, IL 2 of 2

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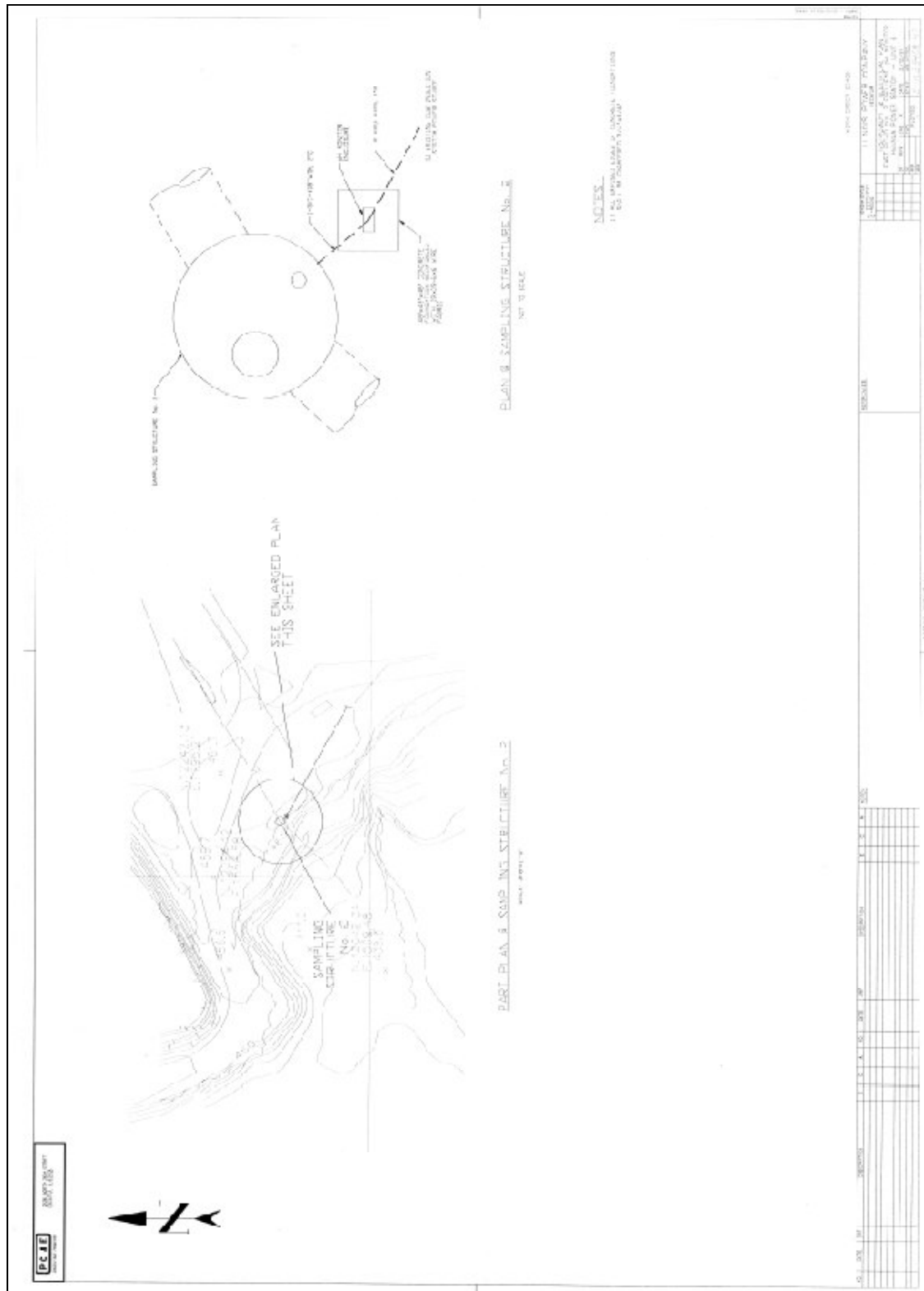
NE Corner of Cell 3

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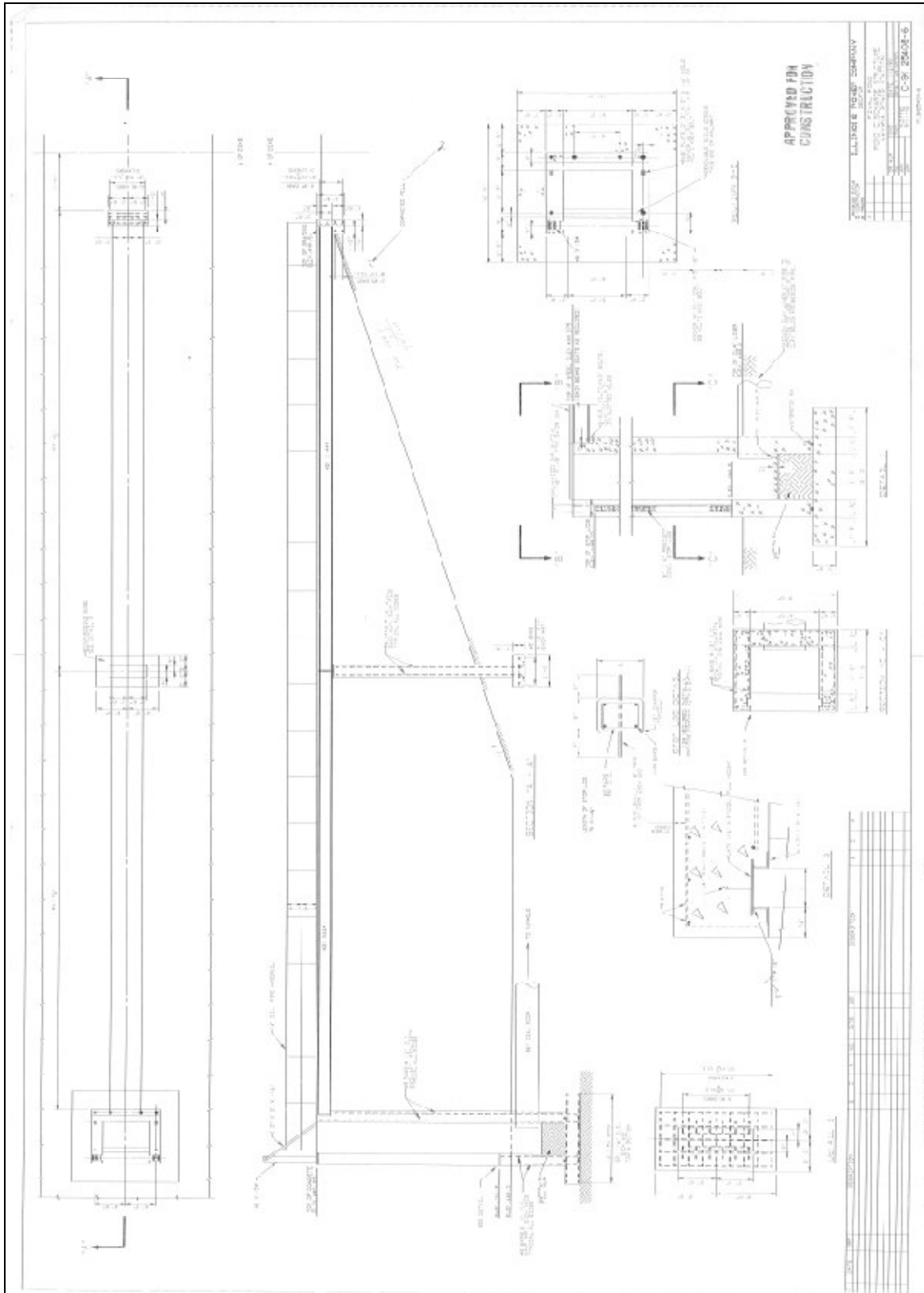
South of Havana Plant

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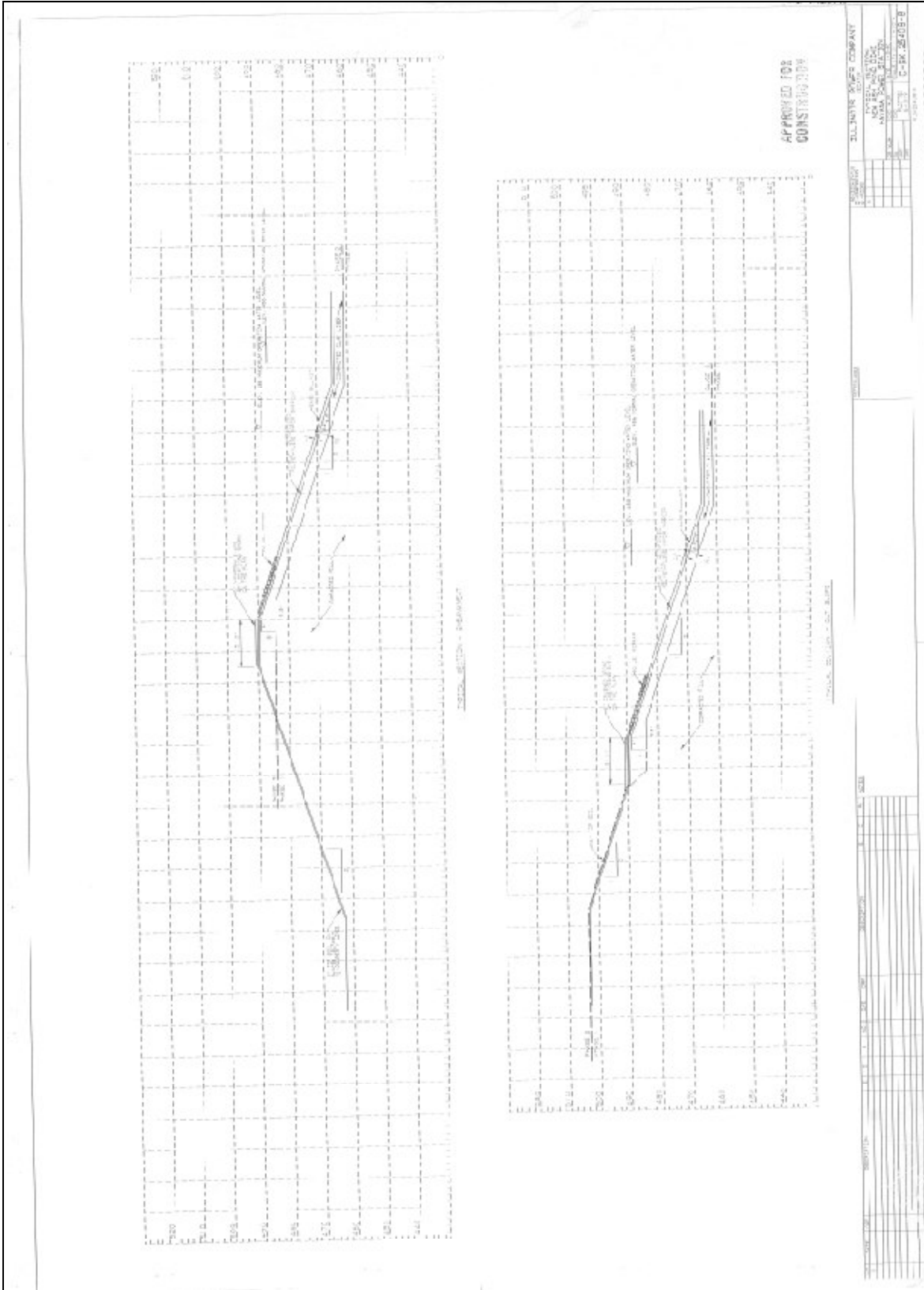


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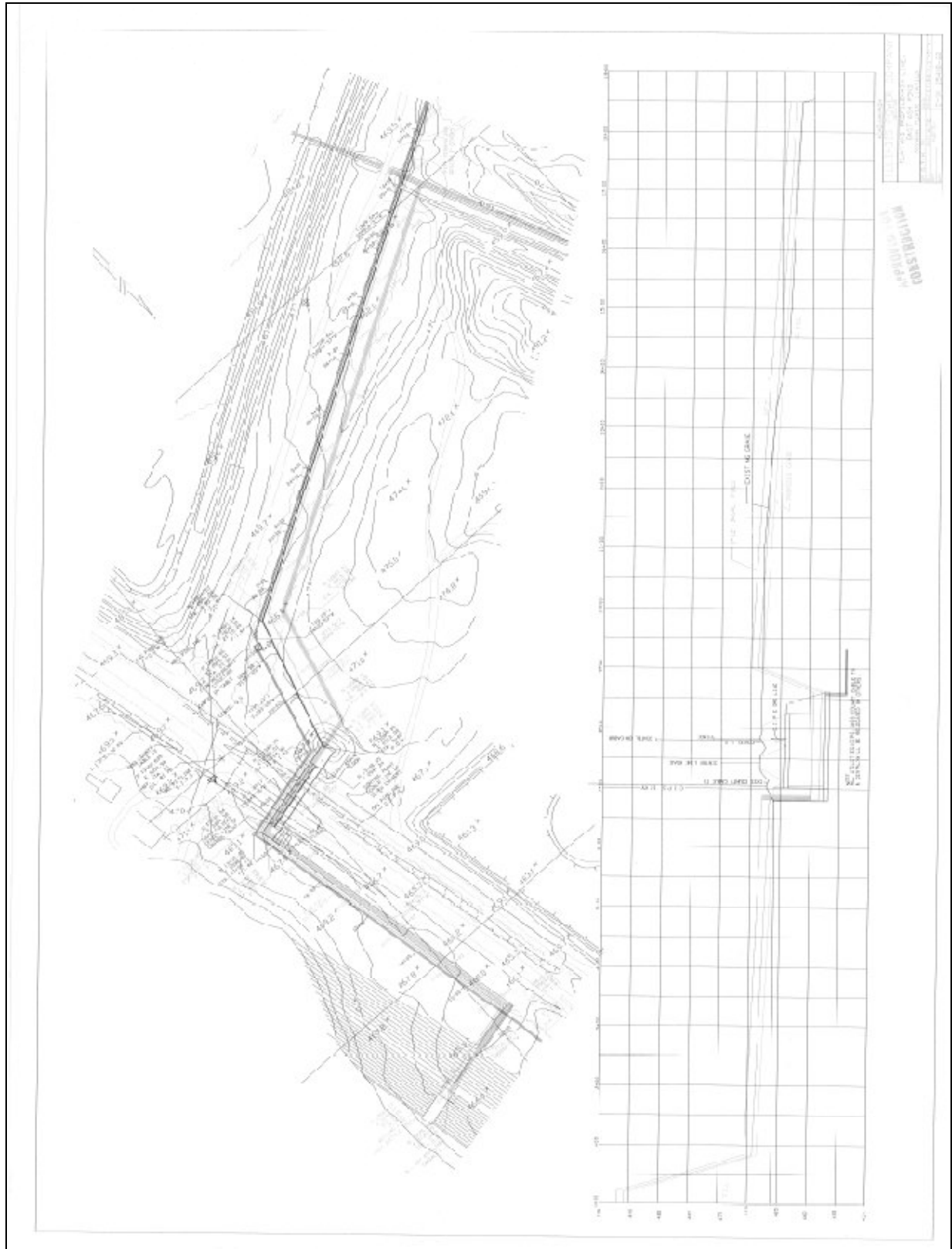
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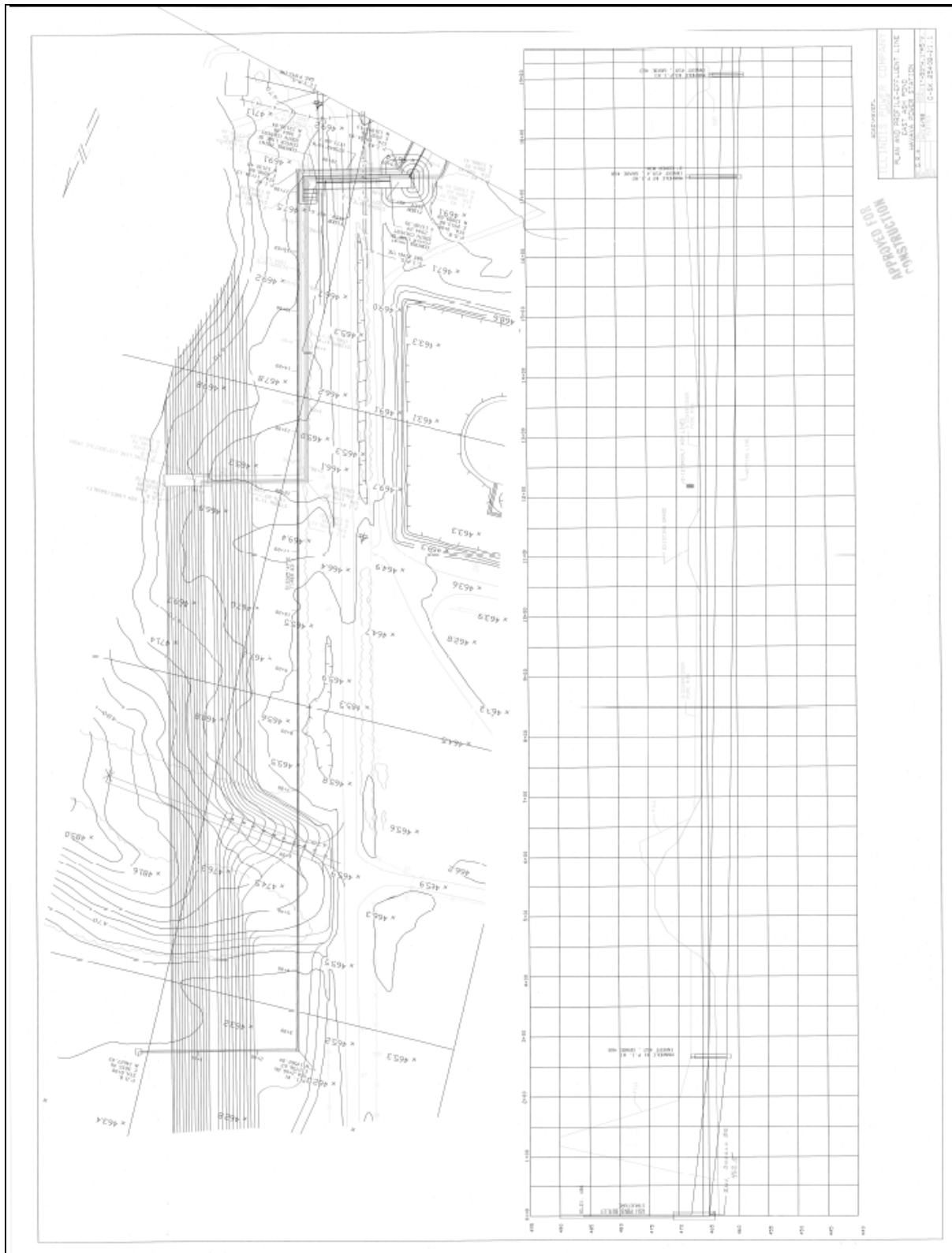
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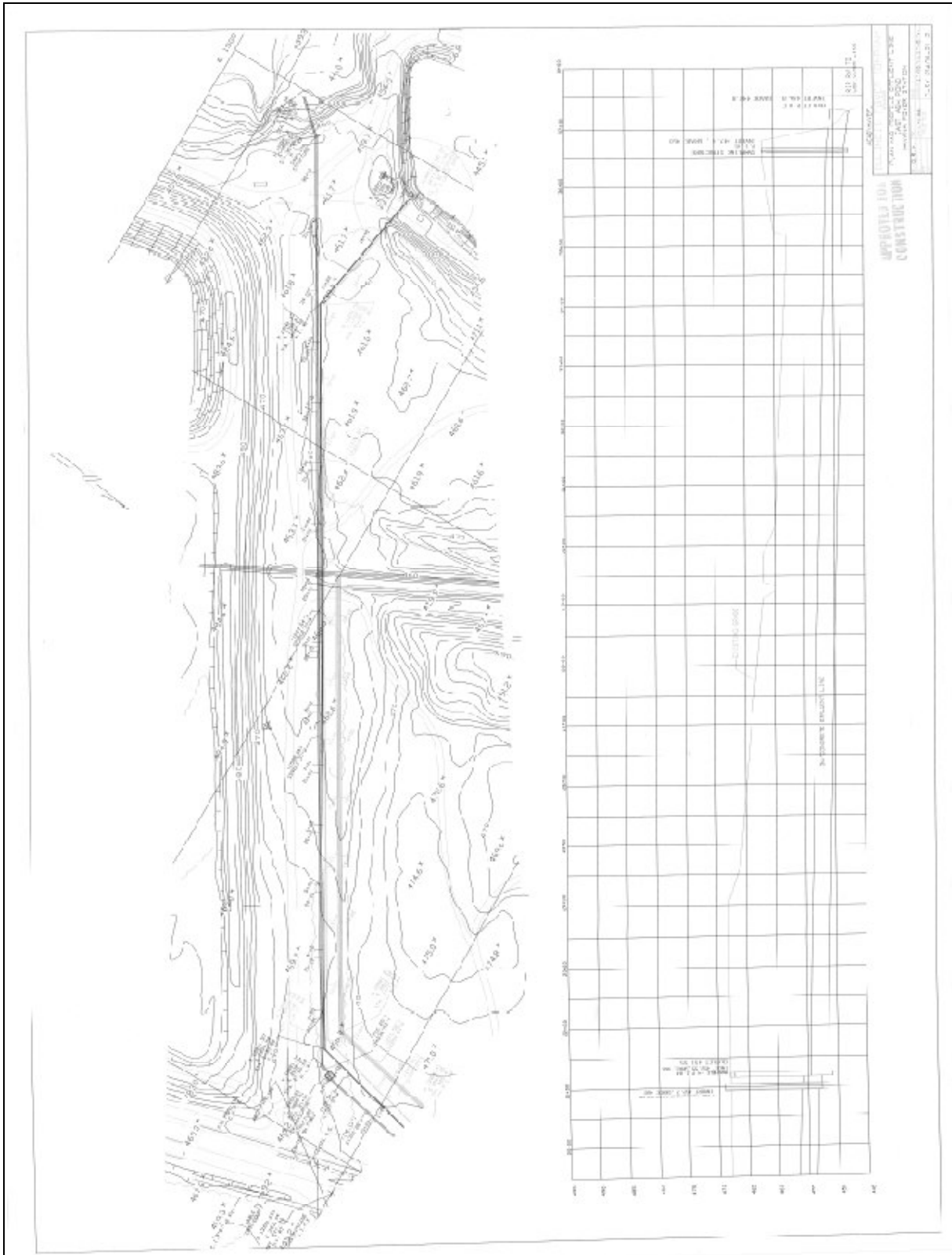
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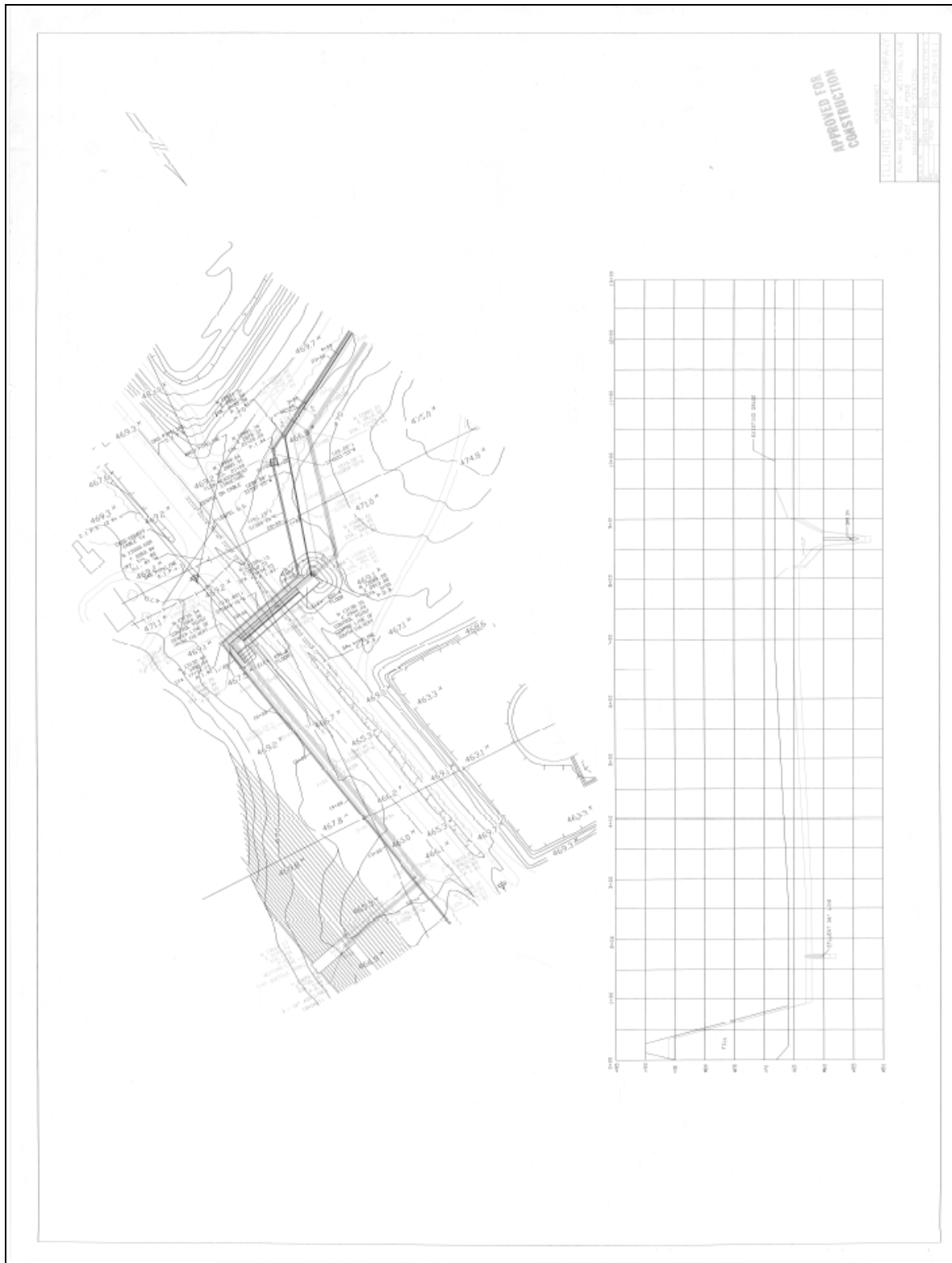
DRAFT



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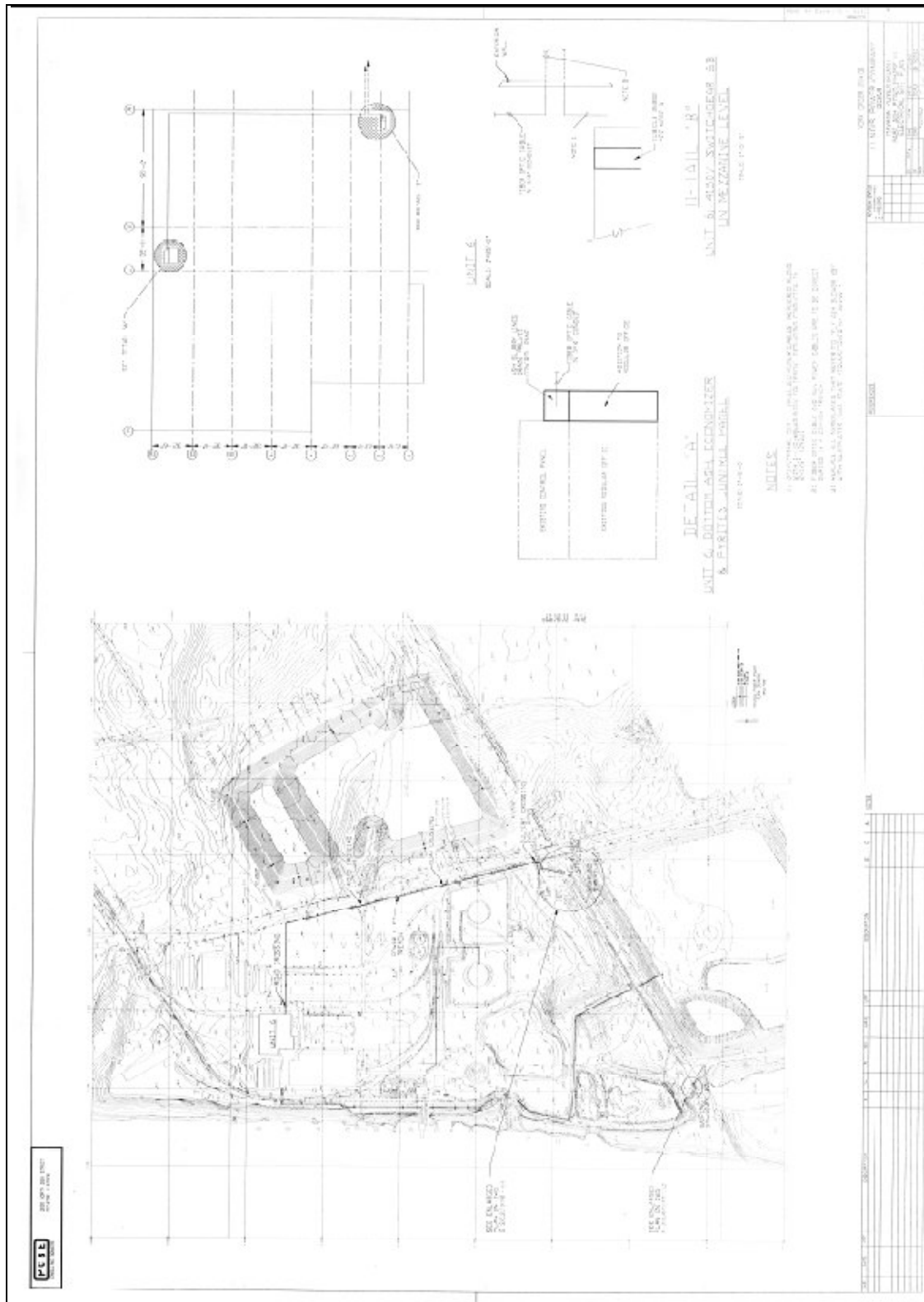


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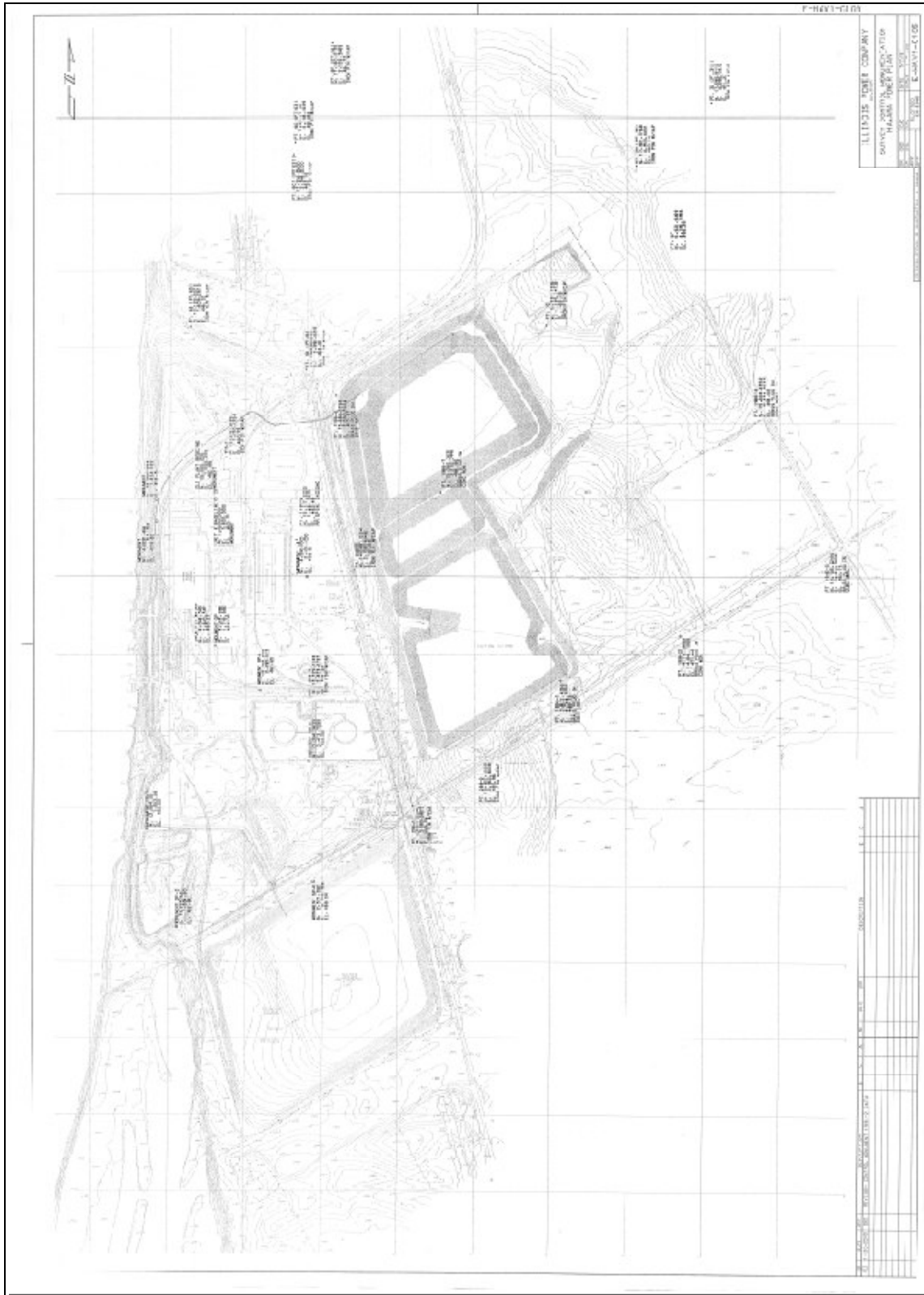


Architectural drawings of a power station, including a plan view, a section view, and a detail view of a wall. The plan view shows the layout of the station with dimensions and labels for various components. The section view shows the internal structure and components. The detail view shows a close-up of a wall section with reinforcement and dimensions.

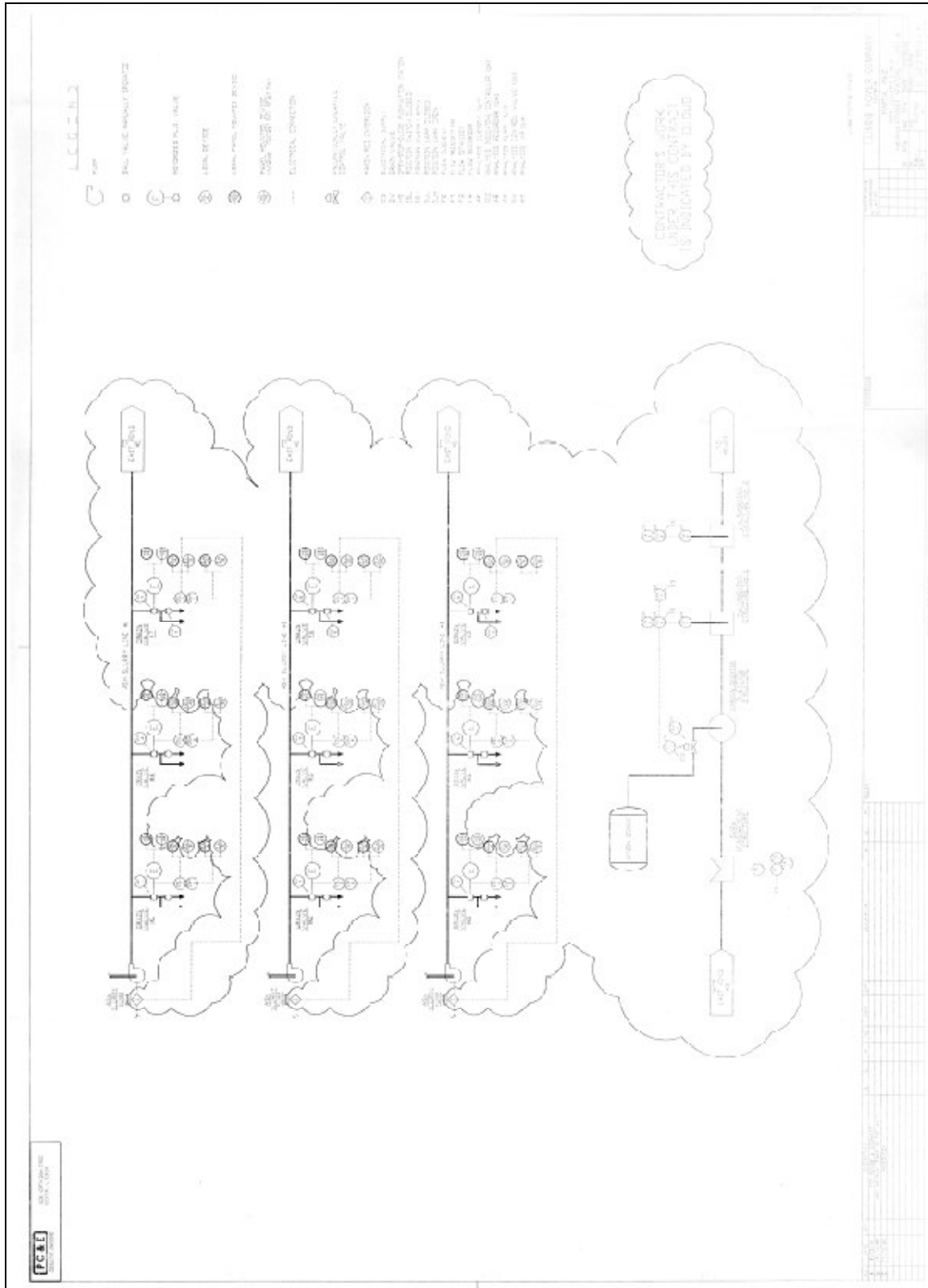
*Havana Power Plant
Dynegy Midwest Generation, Inc.
Havana, IL*



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HAVANA POWER PLANT
HAVANA, ILLINOIS

EAST ASH POND PHASE 3
INSTRUMENT & ELECTRICAL CONSTRUCTION PACKAGE

W.O. 25408

ILLINOIS POWER COMPANY
DECATUR, ILLINOIS

FILE

DRAFT

Dynegy Midwest Generation, Inc.

**Havana Power Station
Havana, Illinois**

East Ash Pond System

IDNR Dam Safety Program

Permit No. DS2002185

Dam ID No. IL50483

**Operations
and
Maintenance
Plan**

November 2008

DRAFT

Havana Power Station East Ash Pond System Class 1 Dam Operations and Maintenance Plan

1.0 General

The following operation and maintenance procedures are provided to maintain the structural integrity of the east ash pond system (cells 1, 2, 3, and the final polishing pond - cell 4). Cells 1 and 2, and the final polishing pond of this system are classified as Small Class 1 dams by the Illinois Department of Natural Resources, Office of Water Resources (IDNR_OWR). Cell 3 is classified as an Intermediate Class 1 dam.

Cells 1, 2, and 3 are the primary ash deposition cells of the system. The fourth cell is the final effluent polishing pond. Cells 1, 2, and 3 are not hydraulically connected.

Water elevations in cell 4 will be slightly lower than in cells 1, 2, or 3. The normal pool elevation of primary cells 1 and 2 of this system is 486 feet above msl. Cell 1 is currently used only for the deposition of bottom ash and there is minimal free standing water in the pond. Cell 2 was taken out of service after cell 3 was constructed and placed into service (2003).

The normal pool elevation of cell no. 3 is 492 feet above msl. The emergency spillway crest in cell 3 is at approximate elevation 494 feet above msl. This emergency spillway consists of a concrete overflow channel which would discharge to the final effluent polishing pond.

2.0 Operation

2.1 Normal Operation and Surveillance

Ash disposal facility operation will be controlled by limiting discharges from the station to cells 1, 2, or 3 and by varying water surface elevations at the final effluent polishing pond (cell 4) discharge structure.

(a) Ash Pond Monitoring

An Ash Pond Log shall be used to establish and maintain pond history. All inspections and maintenance activities shall be recorded. Responsibility for maintaining this log shall be designated by the Station Manager.

(b) Daily Surveillance

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The water surface elevation of each cell of the ash pond system shall be observed and recorded daily in the Ash Pond Log. A staff gauge is installed in each cell of the system and these gauges shall be maintained such that they accurately indicate water level elevations in each cell.

(c) Weekly Surveillance and Inspection

Weekly inspections of the perimeter berms around cells 1, 2, 3, and 4 shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the Ash Pond Log and maintenance activities shall be initiated, if required.

2.2 Emergency Action Plan

During and immediately following unusual storm and flood events, inspection of the cells and their appurtenances shall be carried out and recorded at least once each day.

If the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 487 feet or 492.7 feet in cell 3, inspection of the cells and their appurtenances shall be carried out and recorded at least once every 12 hours.

If the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 488 feet or 494 feet in cell 3, a downstream flood watch will be disseminated and discharges from the station to the ash pond system will be suspended. Inspection of the cells and their appurtenances shall be carried out and recorded at least once every four hours.

When the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 489 feet or 495 feet in cell 3, a flood warning will be disseminated and downstream residents that could experience first floor flooding shall be evacuated. Inspection of the ponds and their appurtenances shall be carried out and recorded at least once every two hours.

When the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 489.25 feet or 495.25 feet in cell 3, all residents within the breach wave area shall be evacuated. Inspection of the ponds and their appurtenances shall be performed and recorded continuously. Residents will not be permitted to return to the breach wave area until the event concludes, the water surface in the cells fall to normal pool levels, and complete inspection of the cells and their appurtenances indicate pond operation to be safe.

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Any unusual condition discovered during major storm events or routine inspection which may constitute an emergency shall be communicated as follows:

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- Notice of any type of emergency involving the berms or outfall shall be made to the Shift Leader on duty.
- The shift leader on duty shall then notify the Station Manager (A.K. Millis; pager and home tel. nos. 309-297-0105; 309-692-8228; kirk_millis@dynegy.com) or in his absence the Production Manager (B.W. Veech; pager and home telephone nos. 309-303-5678 and 815-664-2608, respectively; e-mail address: byron_veech@dynegy.com). One of these shall then notify the following city, county, state, and federal regulatory authorities:

Illinois ESDA, 24-hour service	1-800-782-7860
* IDNR_OWR, Dam Safety Section	217-782-3863
* IDOT, District 6	217-782-7301
* Mason County Sheriff	309-543-2231
* Havana Police Department	309-543-3321
DMG, Director of Construction	618-206-5801
DMG, Operations and Environmental Compliance(OEC)	
.....	618-206-5934 (office)
	618-288-5659 (home)
	618-401-5060 (cellular)

2.3 Dewatering

The Station Manager or the Production Manager shall be responsible for determining how repairs shall be accomplished and whether dewatering of the ash pond cells is necessary. Dewatering shall be accomplished by (a) manually removing the concrete stop logs from cell 4 of the ash pond system and (b) pumping of water from cell 1, or cell 2, or cell 3 to cell 4.

If water from cell 1, cell 2, or cell 3 must be rapidly drained to cell 4, the internal berm between cell 1 and cell 4, or between cell 2 and cell 4, or between cell 3 and cell 4 should be breached, but in a controlled manner. Only portions of a berm should be removed to maintain equalized water levels in cell 4. Breaching should be constantly manned and monitored by station personnel until water levels are equalized. Heavy equipment should be kept available so that, if excessive erosion of a berm begins to occur, berm materials can be replaced.

3.0 Maintenance

3.1. Semiannual Inspections

Semiannual inspections shall be conducted during optimal conditions at approximately six-month intervals to determine the general condition of the berms and discharge structure. Degradation of riprap, berm erosion, tree growth, animal burrows, and berm seepage shall be monitored during these inspections.

3.2 Vegetation

Berms shall be maintained to protect the structural integrity of the ash ponds. Damaged and barren areas shall be repaired as soon as appropriate with topsoil, limed, fertilized, and seeded with appropriate vegetation. Refer to Appendix A for a repair design suggestion.

Trees and shrubs observed during semiannual inspections shall be cut and removed from the berms. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a 3-inch diameter. Low-growing vegetation that will not interfere with inspections shall be planted and maintained. Grass on the slopes of the berms should not be allowed to grow greater than 12 inches in height.

3.3. Intermediate Standpipe Structures, Final Discharge Structure, and Effluent Piping

Intermediate standpipe structures (which allow water to flow from cell to cell) shall be inspected semiannually for significant corrosion, scaling, etc. Structures significantly corroded shall be promptly repaired or replaced. Substantial deposits of scale shall be removed.

The final discharge structure shall be inspected semiannually for significant corrosion and for spalling and cracking of the concrete beams present in the structure. Any defects discovered shall be promptly repaired.

Effluent piping shall be inspected semiannually for excessive corrosion or scaling. Pipe which is significantly corroded shall be promptly replaced. Substantial scale deposits shall be removed. Effluent piping channels shall be inspected semiannual for seepage (infiltration) and corrosion. Excessive infiltration and corrosion shall be repaired.

Erosion of berms around the discharge structure or intermediate standpipe structures be promptly corrected by revetment with riprap or another erosion control method. Refer to Appendix A for a repair design suggestion.

3.4. Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

3.5 Restriction of Unauthorized Vehicles and Personnel

Berm approaches shall be posted with signs and the entire site enclosed by security fencing to prevent unauthorized travel on the roadways and slopes.

3.6. Annual Inspection

An annual inspection shall be made by a licensed Professional Engineer. This inspection shall follow IDNR's "Guidelines and Forms for Inspection of Illinois Dams", and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with the recommendations of the consulting engineer and as outlined above. Copies of the engineer's report along with the corrective action taken shall be reported to the IDNR. An annual statement on forms furnished by the IDNR certifying compliance with the above maintenance plan shall be submitted to the IDNR.

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Havana Station IDNR O&M Plan

DRAFT



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 – (217) 782-3397
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601 – (312) 814-6026

DOUGLAS P. SCOTT, DIRECTOR

May 22, 2009

Mr. Rick Diericx
Senior Director, Operations Environmental Compliance
Dynergy Midwest Region Operations
604 Pierce Boulevard
O'Fallon, Illinois 62269

Dear Mr. Diericx:

This letter is in response to Dynergy's "2008 Closure Work Plan Annual Report" (Annual Report) and cover letter for the Havana South Ash Pond System, received by the Illinois Environmental Protection Agency (Illinois EPA) on October 6, 2008.

In the cover letter, Dynergy requests that the Illinois EPA give written approval for the discontinuation of all Groundwater monitoring at the South Ash Pond site and provide a declaration of closure. Such action will cause the groundwater management zone (GMZ) established June 1996, in accordance with consent decree 89-CH-5, to expire.

Pursuant to 35 IAC 620.250(c):

A groundwater management zone expires upon the Agency's receipt of appropriate documentation which confirms the completion of the action taken pursuant to subsection (a) and which confirms the attainment of applicable standards as set forth in Subpart D.

The Annual Report provides data indicating that during the most recent five years of monitoring, four monitoring wells Well 04, Well 15, Well 23 and Well 25 have had boron and/or manganese concentrations higher than the Class I numerical groundwater standard. No other monitoring wells have exceeded the Class I numerical groundwater standards (35 IAC 620.410) during that time period.

Based on the data provided, Well 23 is within the outer most edge (620.240(f)(1)) of the closed impoundment. The applicable groundwater standard is Class IV groundwater. The Class IV groundwater standards are equal to existing concentrations (i.e. constituent concentrations must not increase). The monitoring data provided indicates that both boron and manganese concentrations show a decreasing trend in Well 23. Therefore, Well 23 appears to be in compliance with the applicable standards of 35 IAC 620.

ROCKFORD – 4302 North Main Street, Rockford, IL 61103 – (815) 987-7760 • DES PLAINES – 9511 W. Harrison St., Des Plaines, IL 60016 – (847) 294-4000
ELGIN – 595 South State, Elgin, IL 60123 – (847) 608-3131 • PEORIA – 5415 N. University St., Peoria, IL 61614 – (309) 693-5463
BUREAU OF LAND - PEORIA – 7620 N. University St., Peoria, IL 61614 – (309) 693-5462 • CHAMPAIGN – 2125 South First Street, Champaign, IL 61820 – (217) 278-5800
SPRINGFIELD – 4500 S. Sixth Street Rd., Springfield, IL 62706 – (217) 786-6892 • COLLINSVILLE – 2009 Mall Street, Collinsville, IL 62234 – (618) 346-5120
MARION – 2309 W. Main St., Suite 116, Marion, IL 62959 – (618) 993-7200

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While Well 25 is within 25 feet of the edge of the closed impoundment, available data indicates that the well is screened more than 15 feet below the base of the impoundment, and is therefore monitoring Class I groundwater. Wells 04 and 15 are down gradient and are also monitoring Class I groundwater. During the most recent five years of monitoring all three of these wells have had manganese concentrations higher than the Class I numerical groundwater standard.

Pursuant to 35 IAC 620.410(a)

Inorganic Chemical Constituents

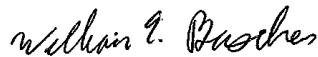
Except due to natural causes or as provided in Section 620.450, concentrations of the following chemical constituents must not be exceeded in Class I groundwater:

Based on a review of the monitoring data provided and the conclusions of the 2002 EPRI report, the concentrations of manganese in these three wells appear to be due to natural aquifer conditions. Under these circumstances, Wells 04, 15 and 25 are in compliance with the applicable standards of 35 IAC 620.450(a)(4)(A), and no reporting pursuant to 35 IAC 620.450(a)(5) is required.

Based on the Illinois EPA's review and interpretation of the data submitted by Dynegy, the requirements of 35 IAC 620.250(c) have been satisfied. Therefore, the Havana South Ash Pond GMZ shall expire as of the date of this letter. The Havana South Ash Pond is considered to be closed and no further monitoring or reporting is required pursuant to the GMZ.

I trust this responds to your needs. If you have further questions or concerns please contact Lynn Dunaway or my staff or me at (217) 785-4787.

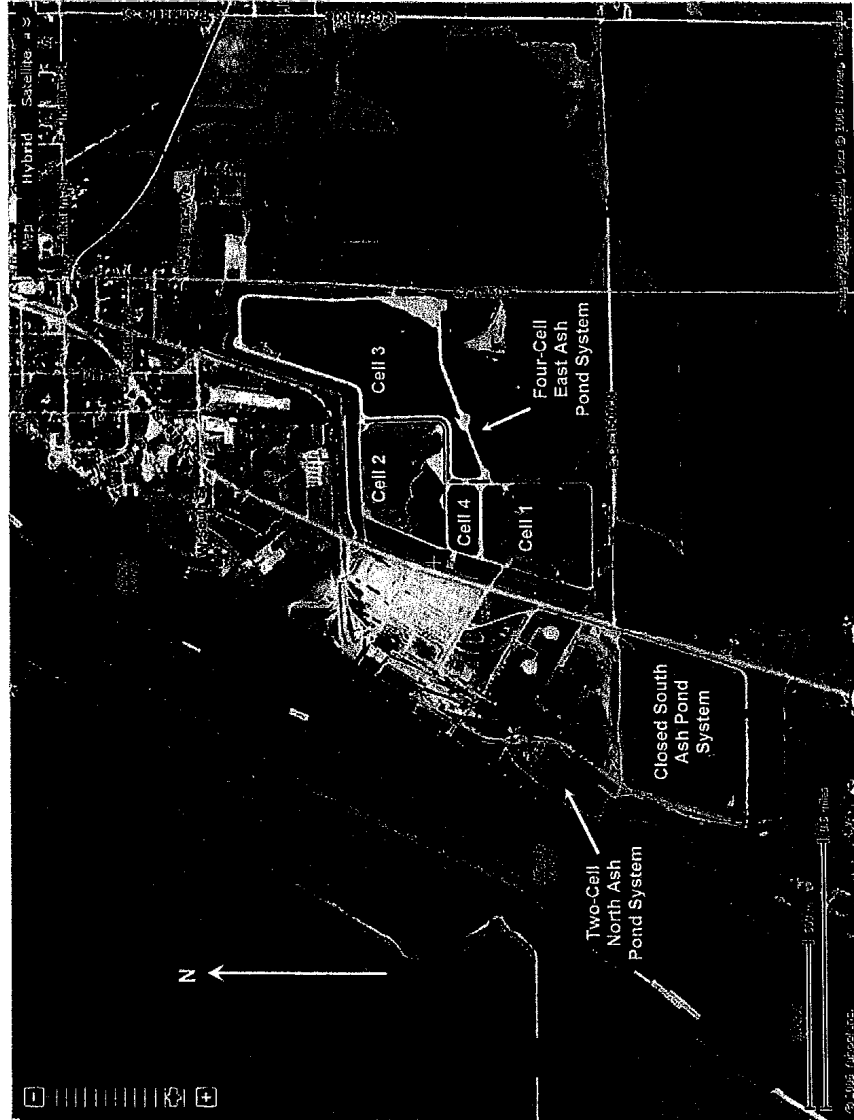
Sincerely,



William E. Buscher, P.G.
Supervisor, Hydrogeology and Compliance Unit
Groundwater Section
Division of Public Water Supplies
Bureau of Water

CC: Al Keller, BOW Permits
Connie Tonsor, DLC
Mike Garretson, CAS
Lynn Dunaway
Groundwater File

DRAFT

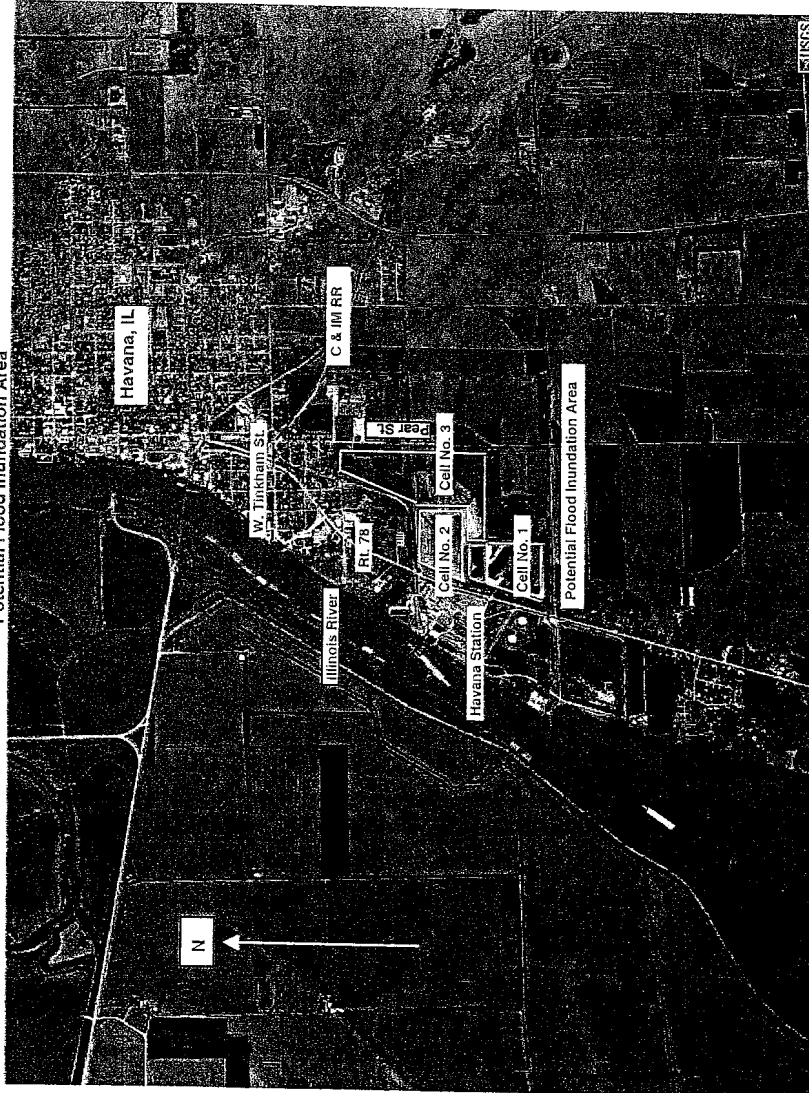


Havana Station Ash Pond Systems

H-A1

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Havana Power Station
Emergency Action Plan for East Ash Pond System
Potential Flood Inundation Area



HA2

Insert 1-4

South Side of Havana, IL

Illinois River

Perimeter of Potential Flood Inundation Area

C & IM Railroad

Perimeter of Potential Flood Inundation Area

Atwood Ave.

Cell No. 1

Cell No. 2

Cell No. 3

Polishing Pond

North Arrow

© 2000 DeLorme, Street Atlas USA; © 2000 GDT, Inc., Rel. 04/2000

Insert 1-5

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 – (217) 782-3397
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HA4

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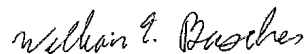
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Sincerely,



William E. Buscher, P.G.
Supervisor, Hydrogeology and Compliance Unit
Groundwater Section
Division of Public Water Supplies
Bureau of Water

CC: Al Keller, BOW Permits
Connie Tonsor, DLC
Mike Garretson, CAS
Lynn Dunaway
Groundwater File

H45

DRAFT



**Design Calculations and Commentary
Submitted for a Dam Safety Construction Permit**

**Dynegy- Illinois Power
Havana Power Plant
East Ash Pond #3**

January 2002



David M. Gaskins
1/14/02

license expires 11/30/03

HA6

DRAFT

**Design Calculations and Commentary
Submitted for a Dam Safety Construction Permit**

**Dynegy- Illinois Power
Havana Power Plant
East Ash Pond #3**

January 2002

HA7

DRAFT

Design Calculations and Commentary
Submitted for a Dam Safety Construction Permit

Dynegy- Illinois Power
Havana Power Plant
East Ash Pond #3

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Introduction
Wave Runup / Freeboard
Hydrology and Hydraulics
Effluent Pipe Analysis
Energy Dissipation
De-watering
Seepage
Breach Analysis
Slope Stability Analysis
Soil Reports
Auxiliary Spillway Analysis
Maps

HA8

DRAFT

**Introduction to Engineering Calcs.
Havana Power Station
East Ash Pond #3B**

**September 14, 2001
JHK**

This manual contains the engineering calculations for the #3B cell of the Havana Power Plant East Ash Pond system. This facility is owned and operated by Illinois Power Company of Decatur, Illinois, a subsidiary of Dynegy, Corp. Its construction will be very similar to the initial ponds of the east ash pond system built in 1992/93 under permit number 20748 and the pond system built in 1998/99 under permit number . The most significant change in construction between the #3B cell and the initial ponds will be the relative size of the new pond, with a storage volume over 2.2 million cubic yards.

The liner for cell #3B will consist of one foot of compacted glacial till clay brought in from off site covered with a 45-mil polypropylene geomembrane. The membrane is essentially impervious to water. The clay layer is to provide additional protection against seepage in the event of pinholes or seaming defects in the membrane. The ponds built in 1992/93 have a three-foot clay liner without a geomembrane.

The maximum toe to crest height for the cell #3B embankment is 34 feet.

Cell #3B will receive no stormwater runoff except for rain that falls directly on the cell or the top of the embankment. All plant waste streams currently going to cell #2 will be redirected to the new cell. These result in a maximum of 11.9-cfs flow into the pond. In an emergency, plant flows can be shut off in a relatively short time.

Outflow from cell #3B will go to the existing polishing pond. From there, the existing outlet works will carry the water to a backwater area of the Illinois River. The only new piping work is the standpipe in cell #3B that directs the outflow to the polishing pond.

The accompanying project plans show the construction details for the new cell. The embankment will be constructed of the on-site soils compacted to no less than 95% of the Standard Proctor density. The clay liner will also be compacted to not less than 95% of Standard Proctor density. A competent inspector, who has experience in this type of work, will observe all construction. The inspector will be hired by the Owner and will be completely independent of the construction contractor. Furthermore, the Illinois Power Engineering Department will closely follow the project from start to finish.

These calculations are intended for submittal to the Illinois Department of Natural Resources, Office of Water Resources for a construction permit. They have been prepared in accordance with the following Office of Water Resources publications:

1. **Rules for Construction and Maintenance of Dams**
2. **Procedural Guidelines for Preparation of Technical Data to be Included for Permits for Construction and Maintenance of Dams**

HA9

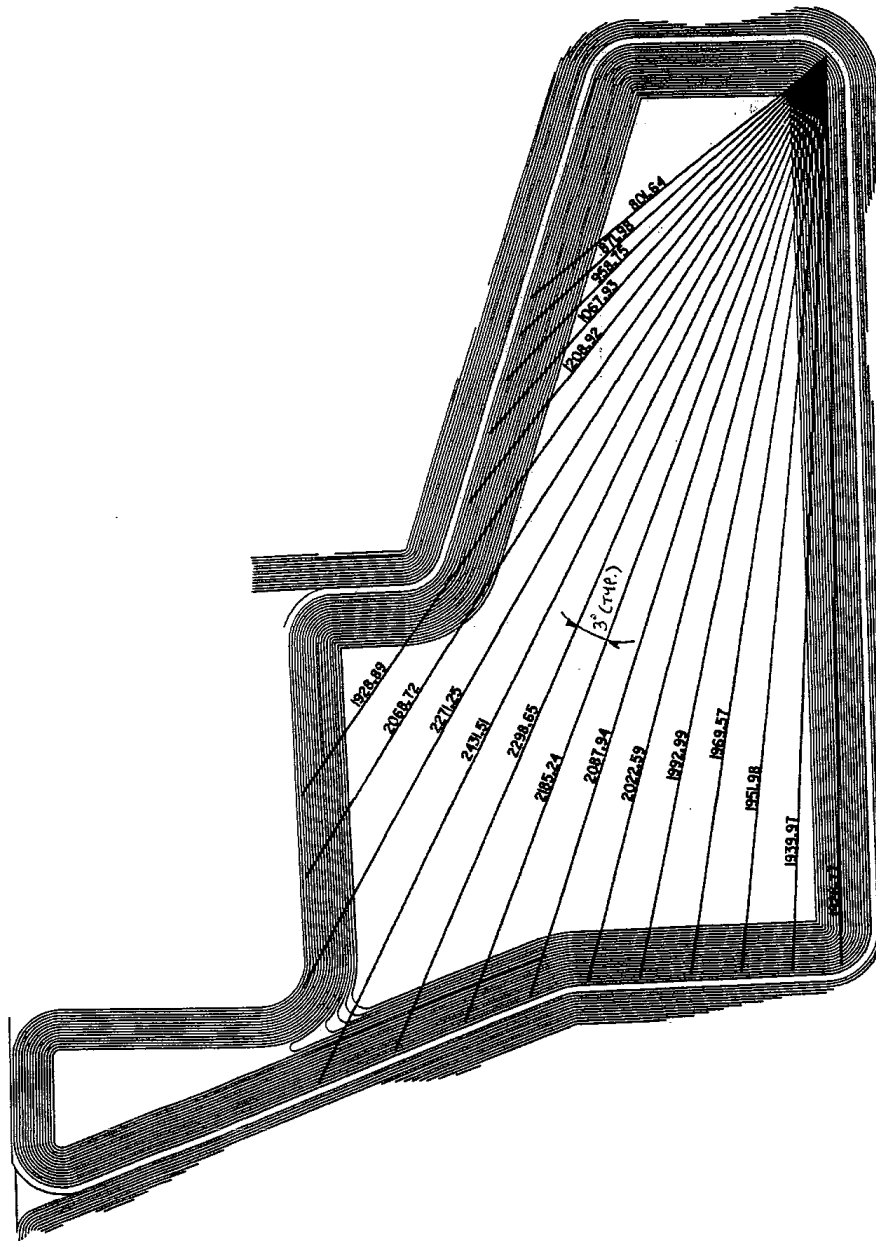
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The table of contents lists the scope of these calculations. They cover hydrology, hydraulics and geotechnical concerns. There are no components of this dam that require structural calculations.

The greatest risk to life and property in the event of a dam breach of the pond system is on State Highway 78 immediately west of cell #2, the power plant adjacent to the highway and the rural township road immediately east of cell #3B and the houses adjacent to the road. The main channel of the Illinois River is approximately ½ mile west of cell #3B. The risk to life and property along the Illinois River caused by a breach of cell #3B is very small.

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HA 10

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Havana East Ash Pond #3B

Fetch Lengths for Wave Runup Analysis

Angle (degrees)	Length (ft.)	Length (mile)	cosine alpha	Length*cos. (mi.)
18	1928.89	0.365	0.951	0.347
15	2068.72	0.392	0.966	0.378
12	2271.25	0.430	0.978	0.421
9	2431.51	0.461	0.988	0.455
6	2298.65	0.435	0.995	0.433
3	2185.24	0.414	0.999	0.413
0	2087.94	0.395	1.000	0.395
3	2022.59	0.383	0.999	0.383
6	1992.99	0.377	0.995	0.375
9	1969.57	0.373	0.988	0.368
12	1951.98	0.370	0.978	0.362
15	1939.97	0.367	0.966	0.355
18	1928.77	0.365	0.951	0.347

Summations: 12.753 5.034

Feff. = $5.034/12.753 =$ 0.395 miles

HA 12

DRAFT

Subject: Wave Runup and Freeboard calculation for Pond #3B

I. Purpose:

Calculate the maximum wave runup and freeboard required in Pond #3B of Havana East Ash Pond.

II. Assumptions, inputs and references:

References:

- 1.) "Wave Runup and Wind Setup on Reservoir Embankments", U.S. Army Corps of Engineers, Office of the Chief of Engineers, ETL 1110-2-221, November 1976.
- 2.) "Wave Characteristics, Wave Runup and Wind Setup Computational Model" program manual by B.R. Bodine, Corps of Engineers Southwestern Division, January 1986.
- 3.) Calculations done for Havana East ash pond #2
- 4.) 100-yr, 24 hr. rainfall from Frequency Distributions of Heavy Rainstorms in Illinois, Illinois State Water Survey, 1989

HA 13

HA 14

Project	Havana	Project No.	Designer	JHK	Date	11/02/01
Subject: Wave Runup and Freeboard calculation for Pond #3B						
<p>III. <u>Methodology</u></p> <p>Using the methodology outlined in Ref. 1 & 2, calculate the wave runup from the normal water elevation at 492' and check against the freeboard provided of 4' between top of dam at elevation 496' and water elevation of 492'.</p>						
<p>IV. <u>Analysis and Results:</u></p> <p>Top of dam elevation= 496' Normal water elevation= 492' Pond bottom elevation= 455' Pond depth at toe of slope (elev. 492' - elev. 458') = 34' Embankment Slope of 3:1 Volume at elev. 492' = 1,993,412 cu. Yd = 53,822,129 cu. Ft. Area at elev. 492' = 1,928,963 sq. ft.</p> <p>Max. overland winds: 1-min. = 65 mph 1-hr. = 43 mph</p> <p>2-hr. wind estimated at 96% of 1-hr. wind</p> <p>2-hr. = $0.96 \times 43 = 41.3$ mph</p> <p>Maximum fetch = 0.395 mi. (See Excel Spreadsheet output)</p> <p>From fig. 11 of Ref. 1:</p> <p> 6-min. dur. - 58 mph 8-min. dur. - 28 mph 10-min. dur. - 17 mph</p> <p>From Ref.2:</p> <p>Using a $U_D = 65$ mph design wind and $F_{eff} = 0.395$ mi.,</p> <p>$U_A = 0.589(U_D)^{1.23}$ = $0.589(65)^{1.23}$ = 100 mph</p>						

DRAFT

Subject: Wave Runup and Freeboard calculation for Pond #3B

$$\begin{aligned}H_0 &= 0.0301(U_A)F^{1/2} \\&= 0.0301(100)0.395^{1/2} \\&= 1.89'\end{aligned}$$

$$\begin{aligned}T &= 0.559[(U_A)F]^{1/3} \\&= 0.559[(100)0.395]^{1/3} \\&= 1.90 \text{ sec.}\end{aligned}$$

$$\begin{aligned}L_0 &= 5.12(T^2) \quad \text{where } L_0 = \text{wave length} \\&= 5.12(1.90)^2 \\&= 18.56'\end{aligned}$$

$L_0/2 = 9.28' < \text{avg. pond depth}$, therefore waves are not affected by bottom

$$R_s = (H_0 \sin \theta)[(5.95 \tan \theta) + 1.5][0.123L_0/H_0]^a$$

$$\begin{aligned}\text{where } a &= (1.58 - 2.35 \tan \theta + 0.092 \cot \theta - 0.26)(H_0/d_s) \quad \text{and } d_s = \text{depth of water at toe of slope} \\&= [1.58 - 2.35(1/3) + 0.092(3) - 0.26](1.89/34') \\&= 0.0452\end{aligned}$$

and θ = embankment slope and $\tan \theta = 1/3$

$$\begin{aligned}R_s &= (1.89' \sin 18.43^\circ)[(5.95/3) + 1.5][0.123 \times 18.56'/1.89']^{0.0452} \\&= 2.10'\end{aligned}$$

$$\begin{aligned}R_m &= 1.517R_s \\&= 3.18'\end{aligned}$$

Wind setup

$S = U^2 F_u / 1440D$, where U = wind speed (mph), $F_u = 2x(\text{fetch distance})$ and D = avg. depth

$$S = 68^2(2)(0.395)/1440 \times 34' = 0.075'$$

$$\begin{aligned}\text{Maximum elevation} &= 3.18' + 0.075' + 492.68' \quad (\text{max. stage elev. from Havana 1.out output}) \\&= 495.93' \sim 496' \quad (\text{Acceptable, since location is only at one point with wind blowing in most critical direction and with maximum wind and stage elev.})\end{aligned}$$

V. Conclusion: Wave Runup and Freeboard acceptable.

HA 15

Hydrologic Analysis/ Spillway Analysis
Havana Power Station
East Ash Pond #3B

November 7, 2001
 JHK

The pond system meets the following two design criteria:

1. For the main spillway, a 100-yr., 24-hr. storm plus maximum plant flow must be safely routed through the pond system. This equals a 7-inch rainfall in 24 hours plus a plant flow of 11.9 cfs (7.70 MGD).
2. For the emergency spillway, a storm equal to one-half the PMP storm plus maximum plant flow must be safely routed through the pond system. One half the PMP equals a 16-inch rainfall in 24 hours plus a plant flow of 11.9 cfs (7.70 MGD).

For the pond system, the main spillway and emergency spillway are the same. Standpipes in ponds 1, 2 and 3B, discharge into pond 3. A stoplog structure in pond 3 discharges into an underground 36-inch RCCP that carries the water to the Illinois River. With the exception of the standpipe in the proposed pond 3B, all the outlet structures are existing.

As part of the construction of the new pond, a secondary emergency spillway will be added between ponds 3B and 3. This spillway will be a concrete-lined overflow spillway. It would receive flow only if the 36-inch pipe between ponds 3B and existing pond 3 should become blocked.

From the HEC-1 computer program, the following results were obtained. The HEC-1 runs were run using both the maximum pipe discharge capacity and the pipe discharge capacity based on weir equation. For the $\frac{1}{2}$ PMP storm, the stoplog discharge capacity was based on the weir with end contractions equation. The maximum pond elevations for the 100-yr. storm are below the maximum pond level, as established by wave run-up and setup calculations. It is assumed that wave action will be limited during a $\frac{1}{2}$ PMP storm.

Pond	$\frac{1}{2}$ the PMP storm max. elevation (feet)	max. discharge (cfs)
1	486.92	23
2	486.57	35
3B	493.17	40
3	486.79	93

Pond	100-yr., 24-hour storm max. elevation (feet)	max. discharge (cfs)
1	486.41	8
2	486.21	19
3B	492.68	18
3	485.63	42

HA 10

DRAFT

References used:

1. **Frequency Distributions of Heavy Rainstorms in Illinois**, Illinois State Water Survey, 1989.
2. **Effects of Basin Rainfall Estimates on Dam Safety Design in Illinois**, Illinois State Water Survey, Surface Water Division, 1981.

HA17

DRAFT

01/20/01

Stage-Storage Relationship- Pond 1 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
486.00	0.00	20.93
486.50	10.53	21.17
487.00	21.17	21.42
487.50	31.94	21.66
488.00	42.84	21.91
488.50	53.85	22.15
489.00	64.98	22.39
489.50	76.24	22.64
490.00	87.62	22.88

Normal pool elevation: 486'
Area at normal elevation: 20.93 acres = 911,818 sq. ft.

Max. pool elevation: 490'
Area at max. elevation: 22.88 acres = 996,705 sq. ft.

Nor

HA 18

6/20/01

Stage-Discharge Relationship- Pond 1 at Havana Power Station

Weir Equation	Input
$Q = CLH^{1.5}$	D= dia. of standpipe = 30"
$L = \pi * D$	H= head increment
C= 3.33	

Comments	Stage (ft)	Head (ft)	Q (cfs)
elev. of standpipe	486.00	0.00	0.00
	486.50	0.50	9.25
	487.00	1.00	26.15
pipe flow begins	487.50	1.50	48.05
	488.00	2.00	73.97
	488.50	2.50	103.38
	489.00	3.00	135.90
	489.50	3.50	171.25
	490.00	4.00	209.23

Normal pool elevation: 486'
 Area at normal elevation: 20.93 acres = 911,818 sq. ft.

Max. pool elevation: 490'
 Area at max. elevation: 22.88 acres = 996,705 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.0' head of water. This is conservative for pipe evaluation.

HA 19

DRAFT

6/20/01

Stage-Discharge Relationship- Pond 2 at Havana Power Station

Weir Equation	Input
$Q = CLH^{1.5}$	D= dia. of standpipe = 36"
$L = \pi * D$	H= head increment
C= 3.33	

Comments	Stage (ft)	Head (ft)	Q (cfs)
elev. of standpipe	485.50	0.00	0.00
	486.00	0.50	11.10
pipe flow begins	486.50	1.00	31.38
	487.00	1.50	57.66
	487.50	2.00	88.77
	488.00	2.50	124.06
	488.50	3.00	163.08
	489.00	3.50	205.50
	489.50	4.00	251.08
	490.00	4.50	299.59

Normal pool elevation: 486'
Area at normal elevation: 19.4 acres = 845,135 sq. ft.

Max. pool elevation: 490'
Area at max. elevation: 20.48 acres = 891,891 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.5' head of water. This is conservative for pipe evaluation.

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6/20/01

Stage-Storage Relationship- Pond 2 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
486.00	0.00	19.40
486.50	9.73	19.54
487.00	19.54	19.67
487.50	29.40	19.80
488.00	39.34	19.94
488.50	49.34	20.07
489.00	59.41	20.21
489.50	69.55	20.34
490.00	79.75	20.48

Normal pool elevation: 486'
Area at normal elevation: 19.40 acres = 845,135 sq. ft.

Max. pool elevation: 490'
Area at max. elevation: 20.48 acres = 891,891 sq. ft.

HA21

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11/2/01

Stage-Discharge Relationship- Pond 3B at Havana Power Station

Weir Equation	Input
$Q = CLH^{1.5}$	$D = \text{dia. of standpipe} = 36"$
$L = P \cdot D$	$H = \text{head increment}$
$C = 3.33$	

Comments	Stage (ft)	Head (ft)	Q (cfs)
elev. of standpipe	492.00	0.00	0.00
	492.50	0.50	11.10
	493.00	1.00	31.38
pipe flow begins	493.50	1.50	57.66
	494.00	2.00	88.77
	494.50	2.50	124.06
	495.00	3.00	163.08
	495.50	3.50	205.50
	496.00	4.00	251.08

Normal pool elevation: 492'
Area at normal elevation: 44.28 acres = 1,928,963 sq. ft.

Max. pool elevation: 496'
Area at max. elevation: 46.28 acres = 2,016,020 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.5' head of water. This is conservative for pipe evaluation.

H A 20

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11/2/01

Stage-Storage Relationship- Pond 3B at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
492.00	0.00	44.28
492.50	22.20	44.53
493.00	44.53	44.78
493.50	66.98	45.03
494.00	89.56	45.28
494.50	112.26	45.53
495.00	135.09	45.78
495.50	158.04	46.03
496.00	181.12	46.28

Normal pool elevation: 492'
Area at normal elevation: 44.28 acres = 1,928,963 sq. ft.

Max. pool elevation: 496'
Area at max. elevation: 46.28 acres = 2,016,020 sq. ft.

HA23

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Stage-Discharge Relationship- Polishing Pond 3 at Havana

Weir Equation

$$Q = 3.33 * L * H^{1.5}$$

L = Weir length = 6'

$$Q1 = 3.33 * (L - 0.2 * H) * H^{1.5}$$

Weir length adjusted to account for end contractions

USED ONLY FOR HAVANA 5.OUT AND
HAVANA 6.OUT RUNS

Elevation (ft)	Head (ft)	Q (cfs)	Q1 (cfs)
484.00	0.00	0.00	0.00
484.50	0.50	7.06	6.95
485.00	1.00	19.98	19.31
485.50	1.50	36.71	34.87
486.00	2.00	56.51	52.74
486.50	2.50	78.98	72.40
487.00	3.00	103.82	93.44
487.50	3.50	130.83	115.56
488.00	4.00	159.84	138.53
488.50	4.50	190.73	162.12
489.00	5.00	223.38	186.15
489.50	5.50	257.71	210.47
490.00	6.00	293.64	234.92

H.A. 24

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7/30/01

Stage-Storage Relationship- Pond 3 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
484.50	0.00	4.70
485.00	2.36	4.76
485.50	4.76	4.82
486.00	7.18	4.88
486.50	9.64	4.94
487.00	12.12	5.00
487.50	14.63	5.05
488.00	17.17	5.11
488.50	19.75	5.17
489.00	22.35	5.23
489.50	24.98	5.29
490.00	27.64	5.35

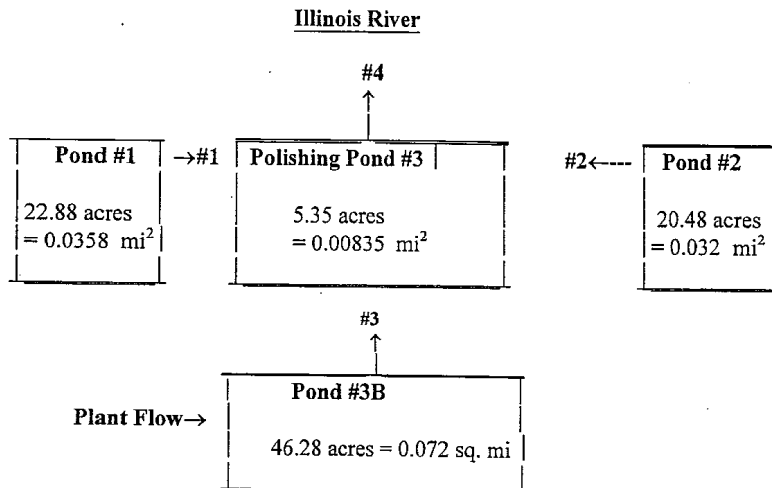
Normal pool elevation: 484.5'
Area at normal elevation: 4.70 acres = 204,790 sq. ft.

Max. pool elevation: 490'
Area at max. elevation: 5.35 acres = 232,886 sq. ft.

HA25

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Principal Outlet Design

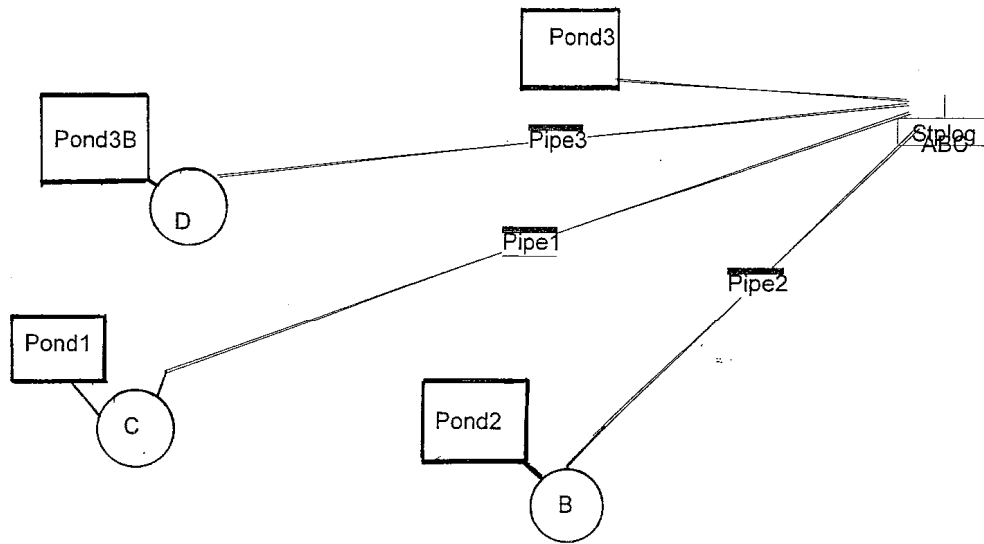


- #1- 30"φ standpipe discharging into bottom of Polishing Pond
- #2- 36"φ pipe between Pond #2 and Polishing Pond
- #3- 36"φ standpipe between Pond #3B and Polishing Pond
- #4- 6' wide stop log structure and 36" φ RCCP to Illinois River

For 24-hr. events, plant flow = 11.9 cfs (7.70 MGD)

HAB

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HA27

7" - 100 yr STORM USING WEIR DISCHARGE @ PUDS 1, 2 & 3B

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW. THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RU-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION. NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS=WRITE STAGE FREQUENCY, DSS=READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID	.....1	.....2	.....3	.....4	.....5	.....6	.....7	.....8	.....9	.....10
2	ID										
3	ID										
4	*DIAGRAM										
5	ID	IT	10	1JAN94	0	160					
6	KK Pond1										
7	KO	0			0	1	22				
8	BA	0.0357									
9	PB	7									
10	IN	6	1JAN94	0							
11	PC	precip1	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083
12	PC	0.0105	0.0116	0.0127	0.0139	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
13	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
14	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
15	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
16	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782

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17	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
21	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
22	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
23	PC	0.663	0.682	0.686	0.713	0.735	0.7434	0.7514	0.7588	0.7656	
24	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
31	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
34	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	PC	1	1	1	1	1	1	1	1	1	1
36	LS	0	100	100							
37	UD	0.15									
38	KK	Pipe1	CNAME	C							
39	KO	0	0	0	0	22					
40	RS	1	ELEV	486	0						
41	SV	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62	
42	SE	* pondlelev	486	487	487.5	488	488.5	489	489.5	490	
43	SQ	* pondlout	0	9.2	26.2	26.2	26.2	26.2	26.2	26.2	
HEC-1 INPUT											
LINE	ID	1	2	3	4	5	6	7	8	9	10
44	KK	Pond2	0	0	1	22					
45	KO	0									
46	BA	0.032									
47	PA	7									
48	IN	6	1JAN94	0							
49	*precip1	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
50	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
51	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
52	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
53	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
54	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
55	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
56	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
57	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
58	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
59	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
60	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
61	PC	0.663	0.682	0.686	0.713	0.735	0.7434	0.7514	0.7588	0.7656	
62	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162

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63	PC	0.82	0.9237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
64	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
65	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
66	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
67	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
68	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
69	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
70	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
71	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
72	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
73	PC	0.9987	0.9999	1	1	1	1	1	1	1	1
74	LS	0	1	1	1	1	1	1	1	1	1
75	UD	0.15	100	100	100	100	100	100	100	100	100
76	KK	Pipe2	CNAME	B							
77	KO	0	0	0	0	0	0	0	0	0	0
78	RS	1	ELEV	486	0	22					
79	SV	0	9.73	19.54	29.4	39.34	49.34	59.41	69.55	79.75	
80	* pond2out										
81	SQ	11.1	31.4	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7
82	* pond2elev										
83	SE	486	486.5	487	487.5	488	488.5	489	489.5	490	
84	KK	Fond3B	New proposed ash pond								
85	KO	0	0	0	1	22					
86	BA	0.072									
87	BF	11.9	0	0							
88	PN	6	1.74994	0							
89	* precip										
90	PC	0.0105	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
91	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
92	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
93	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
94	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
95	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
96	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
97	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
98	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
99	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
100	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
101	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
102	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
103	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
104	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
105	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
106	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
107	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
108	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
109	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
110	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635

PAGE 3

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
91	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
92	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
93	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
94	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
95	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
96	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
97	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
98	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
99	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
100	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
101	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
102	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
103	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
104	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
105	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
106	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
107	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
108	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635

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109	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.9677	0.9762	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9667	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
112	PC	1	1	1	1	1	1	1	1	1	1
113	LS	0	100	100	100	100	100	100	100	100	100
114	UD	0.15									
115	KK	Pipe3	CNAME	D							
116	RS	0	0	0	0	0	22				
117	RS	1	ELEV	486	0						
118	SV	0	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.112	
119	SE	492	492.5	493	493.5	494	494.5	495	495.5	496	
120	SQ	0	11.1	31.38	57.66	57.66	57.66	57.66	57.66	57.66	
121	KK	Pond3									
122	KO	0	0	0	1	22					
123	BA	0.0083									
124	BF	0	0	0							
125	PB	7									
126	IN	6	1JAN94	0							
127	PC	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
128	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
129	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
130	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
131	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
132	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
133	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
134	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
135	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
136	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
137	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
138	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3244	0.4308	0.5679
139	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656

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HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
140	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
141	PC	0.82	0.837	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
142	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
143	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
144	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
145	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
146	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
147	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
148	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
149	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
150	PC	0.9867	0.9889	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
151	PC	1	1	1	1	1	1	1	1	1	1
152	LS	0	100	100	100	100	100	100	100	100	100
153	UD	0.15									

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154	KK	ABC	CNAME	Stplog	havanal.out
155	KO	0	0	0	22
156	HC	4			
157	KK	Stplog	CNAME	ABC	
158	KO	0	0	0	22
159	RS	1	ELEV	484	0
160	* pond3vol	0	0	2.36	9.64
161	SV	22.35	24.98	27.64	7.18
162	* pondelv				12.12
163	SE	484	484.5	485	486
164	SE	489	489.5	490	487
165	* pond3out	0	7.06	20	36.7
166	SQ	223.4	257.7	293.6	56.5
167	* pondelv				79
168	SE	484	484.5	485	486
	SE	489	489.5	490	487
	ZZ				487

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

6 Pond1
V
38 Pipel
V
44 Pond2
V
76 Pipe2
V
82 Pond3B
V
115 Pipe3
V
121 Pond3
V
154 ABC
V
157 Stplog
V

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

* FLOOD HYDROGRAPH PACKAGE (HEC-1) *

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HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS CALIFORNIA 95616
(916) 551-1746

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MAY 1991
VERSION 4.0.1E
TIME
RUN DATE

5 IO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IT HYDROGRAPH TIME DATA
NMIN 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NQ 160 NUMBER OF HYDROGRAPH ORDINATES
NDATE 2JAN94 ENDING DATE
NDTIME 0230 ENDING TIME
ICENT 19 CENTURY MARK
COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS
ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

6 KK Pond1

7 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
Page 6

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A

WA 20

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IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2 160 LAST ORDINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

78 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION	ITYP	ELEV TYPE OF INITIAL CONDITION
	RSVRIC X	0.00 WORKING R AND D COEFFICIENT		
79 SV	STORAGE	0.0 9.7 19.5 29.4	39.3	59.4 69.6 79.7
80 SQ	DISCHARGE	11. 31. 58.	58.	58. 58.
81 SE	ELEVATION	486.00 486.50 487.00 487.50	488.00 489.00 489.50	489.00 489.50 490.00

* * Pond3B *
* * New proposed ash pond

83 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0 HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2 160 LAST ORDINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

87 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

84 BA SUBBASIN CHARACTERISTICS
TAREA, 0.07 SUBBASIN AREA

85 BF BASE FLOW CHARACTERISTICS
STRQ 11.90 INITIAL FLOW
ORCSN 0.00 BEGIN BASE FLOW RECESSON
RTIOR 1.00000 RECESSON CONSTANT

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HYDROGRAPH ROUTING DATA
117 RS  STORAGE ROUTING
        NSTPS      1 NUMBER OF SUBREACHES/
        RSVRIC      486.00 INITIAL CONDITION
        X           0.00 WORKING R AND D COEFFICIENT
        STORAGE     0.0   22.2  44.5   67.0   89.6   112.3   135.1   158.0   181.1
118 SV  ELEVATION    492.00  493.00  493.50  494.00  494.50  495.00  495.50  496.00
119 SE  DISCHARGE    0.    11.    31.    58.    58.    58.    58.    58.    58.
120 SQ                                     ***

*****
*
*
* Pond3 *
*
*****

122 KO  OUTPUT CONTROL VARIABLES
        IPRT      4 PRINT CONTROL
        IPLOT     0 PLOT CONTROL
        QSCAL     0. HYDROGRAPH PLOT SCALE
        IPNCH     1 PUNCH COMEUTED HYDROGRAPH
        IOUT      22 SAVE HYDROGRAPH ON THIS UNIT
        ISAV1     1 FIRST ORDNATE PUNCHED OR SAVED
        ISAV2     160 LAST ORDNATE PUNCHED OR SAVED
        TIMINT    0.167 TIME INTERVAL IN HOURS

126 IN  TIME DATA FOR INPUT TIME SERIES
        JXMIN     6 TIME INTERVAL IN MINUTES
        JXDATE    1JAN94 STARTING DATE
        JXTIME     0 STARTING TIME

        SUBBASIN RUNOFF DATA
        SUBBASIN CHARACTERISTICS
        TAREA,    0.01 SUBBASIN AREA

        BASE FLOW CHARACTERISTICS
        STRIQ     0.00 INITIAL FLOW
        QRCN     0.00 BEGIN BASE FLOW RECESSON
        RTOR     1.00000 RECESSON CONSTANT

        PRECIPITATION DATA
        STORM     7.00 BASIN TOTAL PRECIPITATION

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127 PI      INCREMENTAL PRECIPITATION PATTERN      havanal.out
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
0.14 0.19 0.01 0.01 0.03 0.02 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

152 LS      SCS LOSS RATE      0.00 INITIAL ABSTRACTION
          SFTL      100.00 CURVE NUMBER
          CRNBR      100.00 PERCENT IMPERVIOUS AREA
          RTIMP
          TLAG      SCS DIMENSIONLESS UNITGRAPH
          0.15 LAG

153 UD      ***
          UNIT HYDROGRAPH
          7 END-OF-PERIOD ORDINATES
          14.      13.      4.      1.      0.      0.
          0.      0.      0.      0.      0.      0.

154 KK      *****
          *      ABC      *      CNAME Stplot
          *      *      *      *
          *****

155 KO      OUTPUT CONTROL VARIABLES
          IFMT      4 PRINT CONTROL
          IELOT      0 PLOT CONTROL
          QSCAL      0 HYDROGRAPH PLOT SCALE
          IFNCH      0 PUNCH COMPUTED HYDROGRAPH
          IOUT      22 SAVE HYDROGRAPH ON THIS UNIT
          ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
          ISAV2      160 LAST ORDINATE PUNCHED OR SAVED
          TIMINT      0.167 TIME INTERVAL IN HOURS

156 HC      HYDROGRAPH COMBINATION      4 NUMBER OF HYDROGRAPHS TO COMBINE
          ICOMP
```

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*** **

* *
* * Stplot *
* * CNAME ABC
* * *****

158 KO OUTPUT CONTROL VARIABLES

IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
OSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 0 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

159 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES/
RSVRIC 484.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

160 SV STORAGE 0.0 0.0 2.4 4.8 7.2 9.6 12.1 14.6 17.2 19.7
22.4 25.0 27.6

162 SE ELEVATION 484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50
489.00 489.50 490.00

164 SQ DISCHARGE 0. 7. 20. 37. 56. 79. 104. 131. 160. 191.
223. 258. 294.

166 SE ELEVATION 484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50
489.00 489.50 490.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE 0.00 0.00 2.36 4.76 7.18 9.64 12.12 14.63 17.17 19.75
OUTFLOW 0.00 7.06 20.00 36.70 56.50 79.00 103.80 130.80 159.80 190.70
ELEVATION 484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50

STORAGE 22.35 24.98 27.64
OUTFLOW 223.40 257.70 293.60
ELEVATION 489.00 489.50 490.00

D

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
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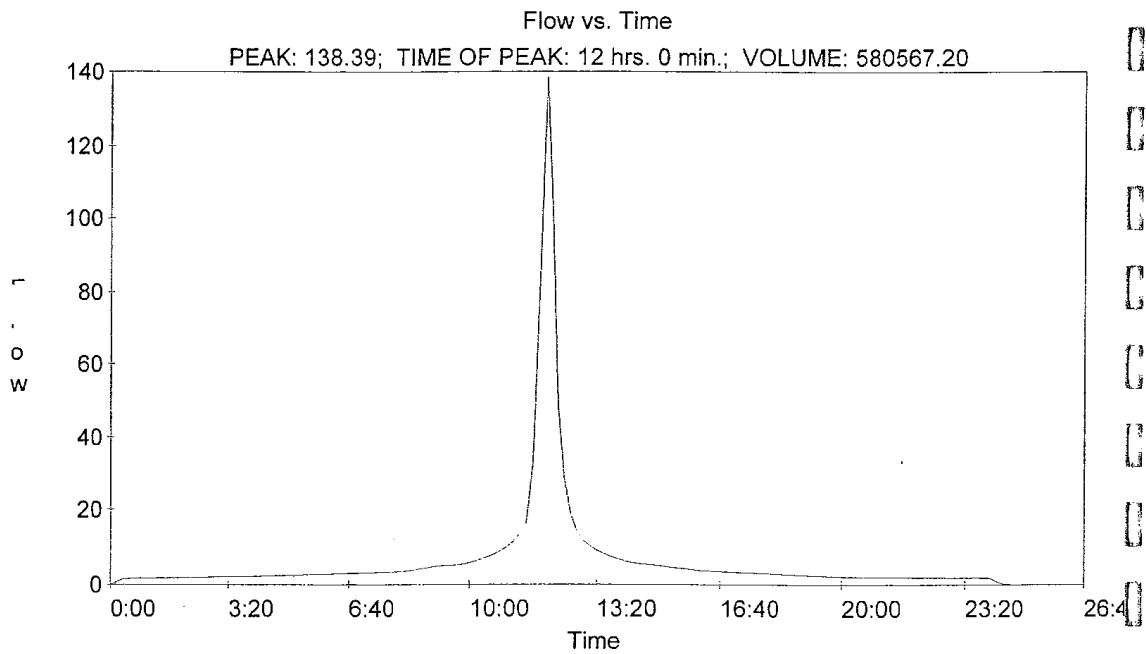
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OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR 24-HOUR 72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+							
+	HYDROGRAPH AT						
+	Pond1	138.	12.00	19.	0.04		
+	ROUTED TO						
+	Pipe1	8.	13.67	7.	0.04	486.41	13.67
+	HYDROGRAPH AT						
+	Pond2	124.	12.00	17.	0.03		
+	ROUTED TO						
+	Pipe2	19.	12.67	15.	0.03	486.21	12.67
+	HYDROGRAPH AT						
+	Pond3B	291.	12.00	50.	0.07		
+	ROUTED TO						
+	Pipe3	18.	17.50	18.	0.07	492.68	17.50
+	HYDROGRAPH AT						
+	Pond3	32.	12.00	4.	0.01		
+	4 COMBINED AT						
+	ABC	62.	12.00	43.	0.15		
+	ROUTED TO						
+	Stplog	42.	15.17	40.	0.15	485.63	15.17
+							

*** NORMAL END OF HEC-1 ***

Page 15

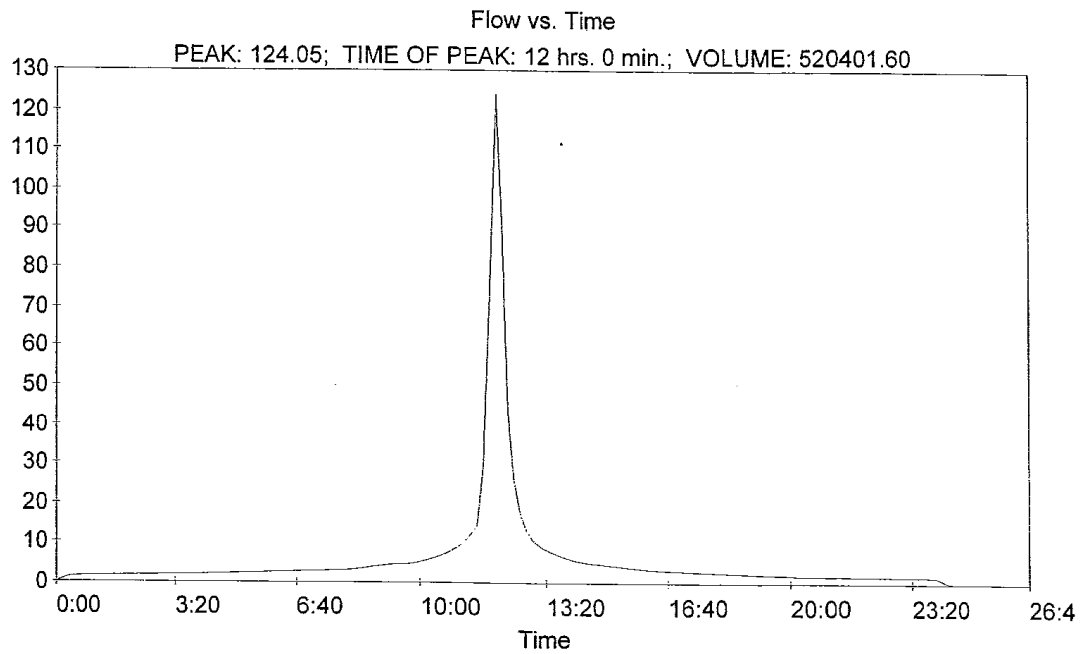
DRAFT



Pond 1 PEAK FLOW
7" - 100 YR STORM

HA 43

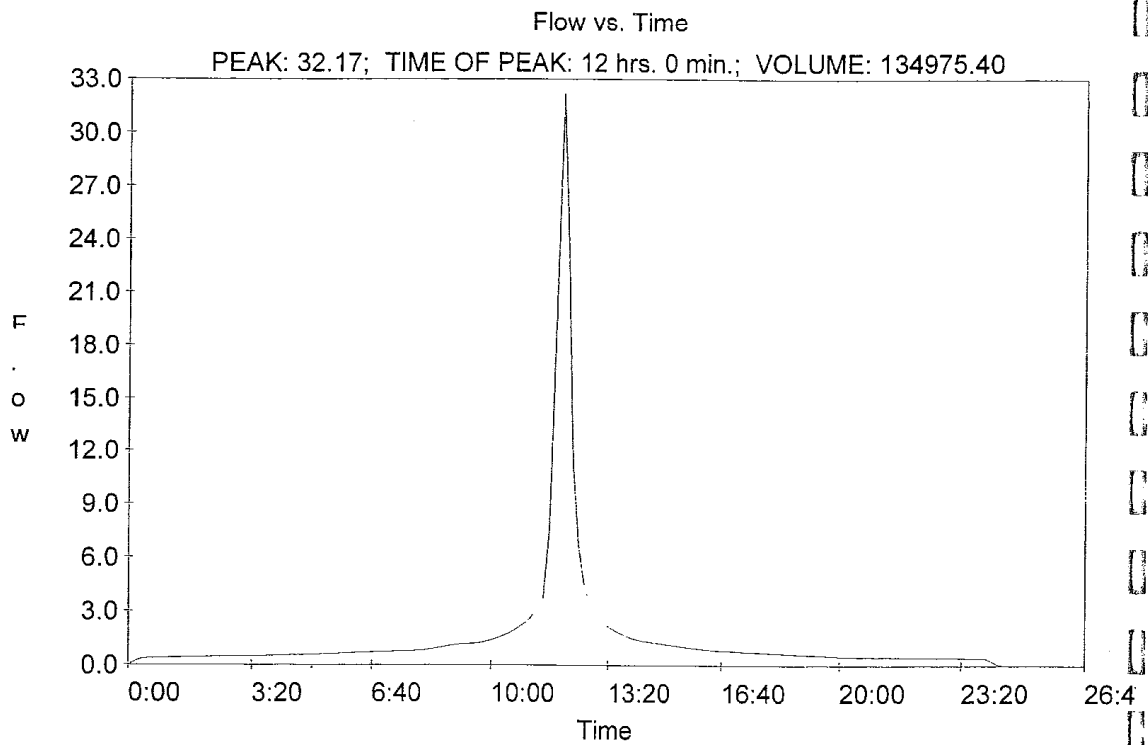
DRAFT



Pond 2 Peak Flow
7" - 100 yr Storm

HADH

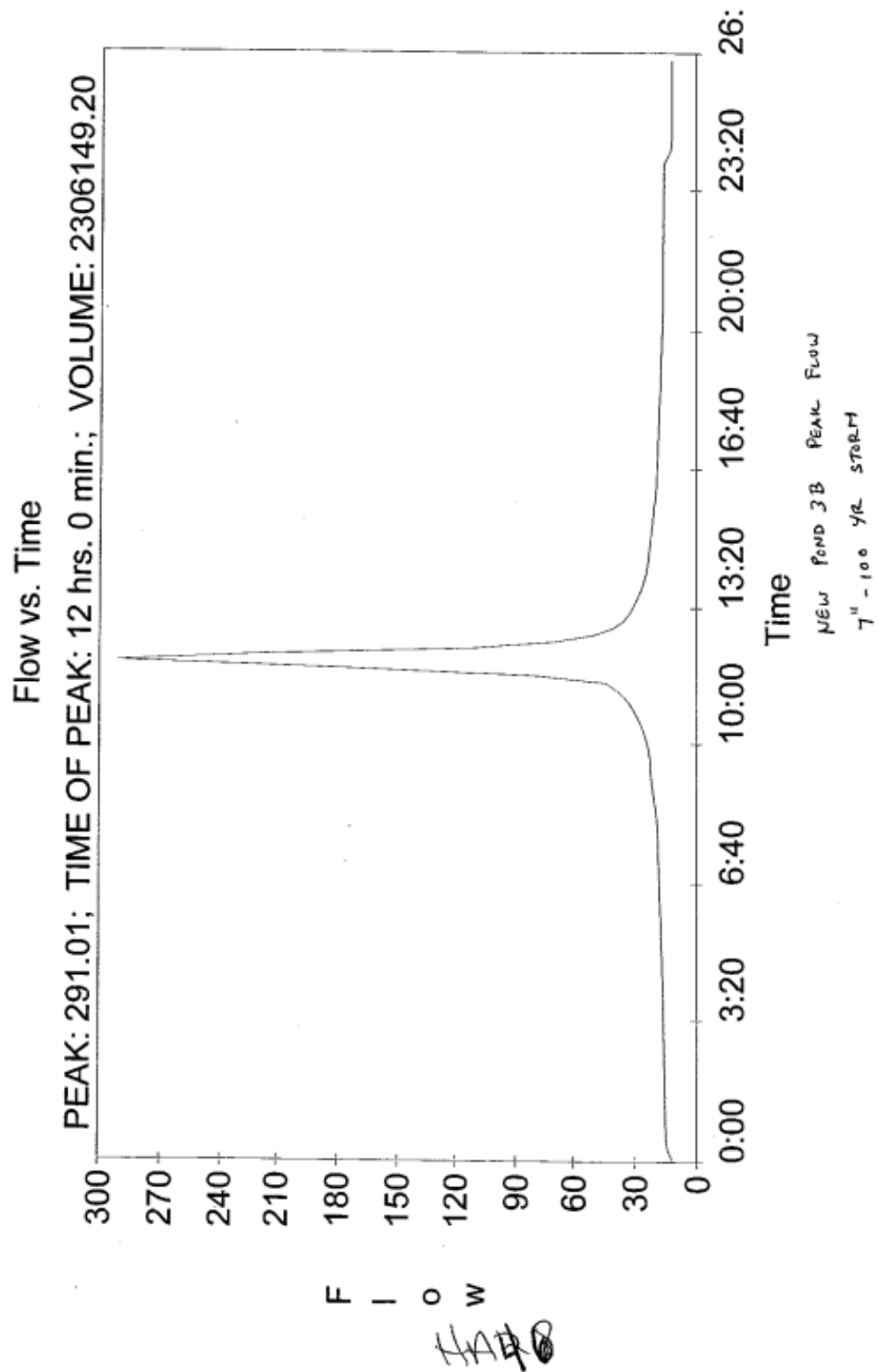
DRAFT



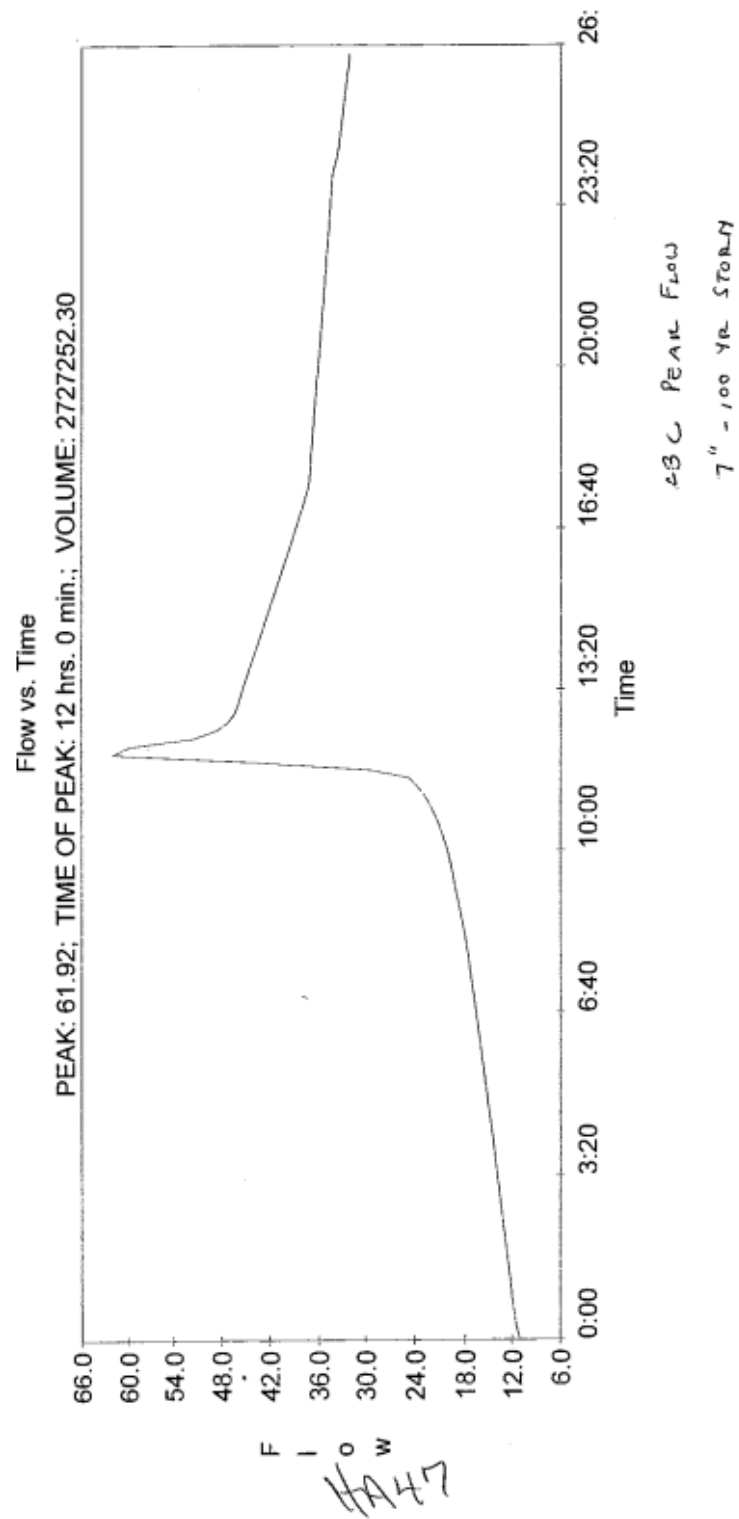
Pond 3 Peak Flow
7" - 100 yr Storm

HA45

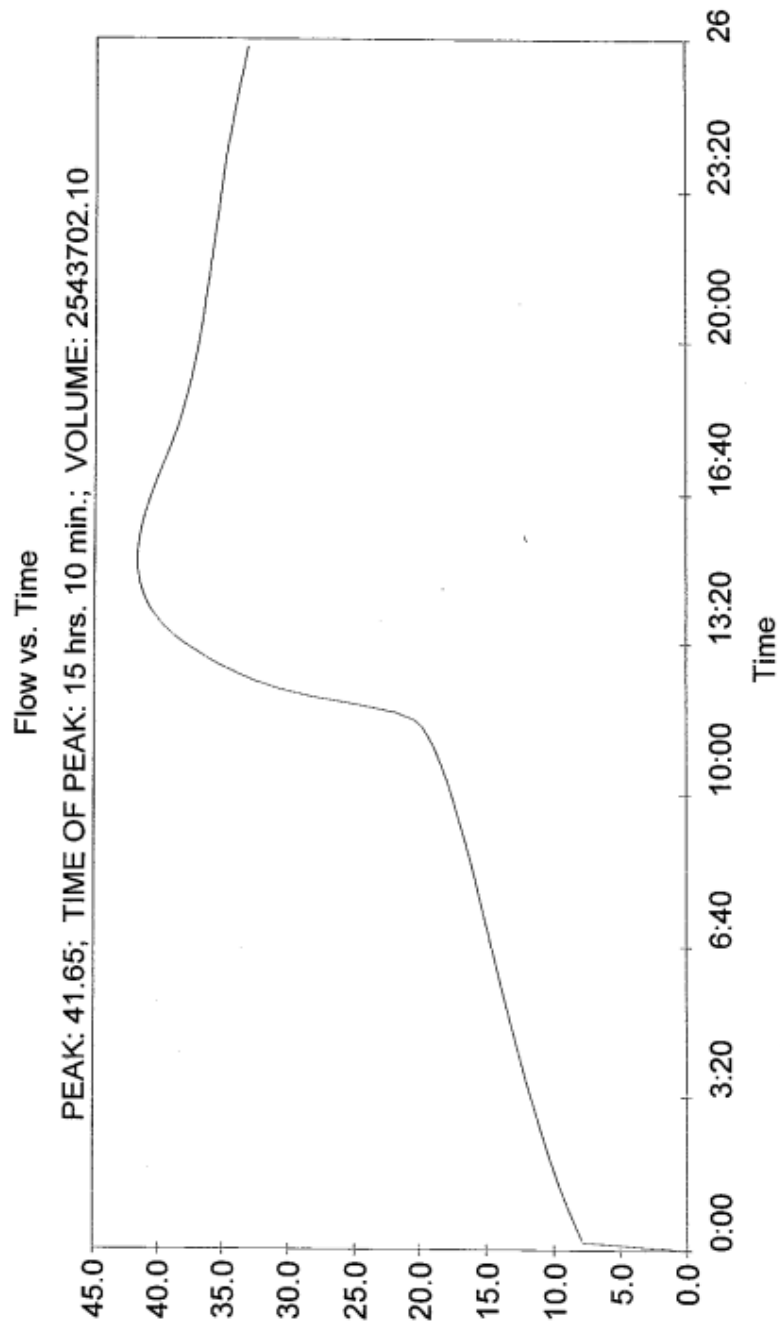
DRAFT



DRAFT



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Stop Log Peak Flow - 7" 100 YR. S

Flow
HA 48

DRAFT

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* MAY 1991 *
* VERSION 4.0.12 *
* RUN DATE TIME *
*****

*****
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 551-1748 *
*****

*****
* 7'-100 YR STORM USING MAX. *
* DISCHARGE @ POWDS 1,2 & 3B *
*****

*****
* HEC-1 INPUT *
*****
LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID
3 ID
4 *DIAGRAM
5 IT 10 1JAN94 0 160
6 IO 4
7 KK Pond1
8 KO 0
9 BA 0.0358
10 PB 7
11 IN 6 1JAN94 0
12 *precip1
13 PC 0 0.001 0.0031 0.0041 0.0051 0.0062 0.0073 0.0083 0.0094
14 PC 0.0105 0.0116 0.0127 0.0138 0.015 0.0161 0.0173 0.0185 0.0196
15 PC 0.022 0.0232 0.0244 0.0257 0.0269 0.0281 0.0294 0.0307 0.0319
16 PC 0.0365 0.0358 0.0371 0.0384 0.0398 0.0411 0.0425 0.0438 0.0452
PC 0.048 0.0494 0.0508 0.0523 0.0538 0.0553 0.0568 0.0583 0.0598
PC 0.063 0.0645 0.0662 0.0679 0.0696 0.0712 0.073 0.0747 0.0764
PC 0.0782
*****
Page 1
```

HA 49

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JUN 73), HEC1GS, HEC1DB, AND HEC1RW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKN- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

DRAFT

17	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
21	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
22	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
23	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
24	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
31	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
34	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	PC	1	1	1	1	1	1	1	1	1	1
36	LS	0	100	100	1	1	1	1	1	1	1
37	UD	0.15									
38	KK	Pipel	CNAME	C							
39	KO	0	0	0	0	22					
40	RS	1	ELEV	486	0						
41	SV	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62	
42	SE	486	486.5	487	487.5	488	488.5	489	489.5	490	
43	SQ	0	9.25	26.15	48.05	73.97	103.38	135.9	171.25	209.23	
HEC-1 INPUT											
LINE	ID	1	2	3	4	5	6	7	8	9	10
44	KK	Pond2	0	0	1	22					
45	KO	0									
46	EA	0.032									
47	FB	7									
48	IN	6	13RM94	0							
49	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
50	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
51	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
52	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
53	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
54	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
55	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
56	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
57	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
58	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
59	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
60	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
61	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
62	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162

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DRAFT

63	PC	0.82	0.8377	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
64	PC	0.833	0.8563	0.8534	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
65	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8958	0.8976	0.8997
66	PC	0.9018	0.9018	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9182
67	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
68	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
69	PC	0.942	0.9433	0.9446	0.9459	0.9472	0.9484	0.9497	0.951	0.9522	0.9535
70	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
71	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
72	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
73	PC	1	1	1	1	1	1	1	1	1	1
74	LS	0	100	100	100	100	100	100	100	100	100
75	UD	0.15									
76	KK	Pipe2	CHARGE	B							
77	KO	0	0	0	0	0	0	0	0	0	0
78	RS	1	ELEV	486	0	0	0	0	0	0	0
79	SV	0	9.73	19.54	29.4	39.34	49.34	59.41	69.55	79.75	
80	SQ	11.1	31.38	57.66	88.77	124.06	163.08	205.5	251.08	299.59	
81	SE	486	486.5	487	487.5	488	488.5	489	489.5	490	
82	KK	Fond3B	New proposed ash pond								
83	KO	0	0	0	0	0	0	0	0	0	0
84	BA	0.072									
85	BE	11.9	0	0	0	0	0	0	0	0	0
86	RB	7									
87	IN	6	1JAN94	0							
88	* precip1	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
89	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
90	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
91	ID	.....1.....	.....2.....	.....3.....	.....4.....	.....5.....	.....6.....	.....7.....	.....8.....	.....9.....	.....10.....
92	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
93	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
94	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
95	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
96	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
97	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
98	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
99	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
100	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.294	0.3068	0.314	0.328
101	PC	0.663	0.682	0.696	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
102	PC	0.772	0.778	0.7836	0.789	0.7942	0.798	0.8036	0.808	0.8122	0.8162
103	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
104	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
105	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8958	0.8976	0.8997
106	PC	0.9018	0.9018	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9182
107	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
108	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
109	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635

PAGE 3

HEC-1 INPUT

Page 3

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DRAFT

109	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
112	PC	1	1	1	1	1	1	1	1	1	1
113	LS	0	100	100							
114	UD	0.15									
115	KK	Pipe3	CNAME	D							
116	PO	0	0	0	0	22					
117	RS	1	ELEV	492	0						
118	* pond3Bvol										
119	* pond3Selev	0	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.121	
120	SE	492	492.5	493	493.5	494	494.5	495	495.5	496	
121	* pond3Bout										
122	SQ	0	11.1	31.38	57.66	88.77	124.06	163.08	205.5	251.08	
123	KK	Pond3									
124	XO	0	0	0	0	1	22				
125	BA	0.0083									
126	BF	0	0	0	0						
127	IN	7									
128	* Precip1	0									
129	PC	0.0105	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
130	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
131	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
132	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
133	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
134	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
135	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
136	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
137	PC	0.12	0.1253	0.1266	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
138	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
139	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
140	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.2968	0.3044	0.3108	0.3179
141	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
142	ID	.....1	.....2	.....3	.....4	.....5	.....6	.....7	.....8	.....9	.....10
143	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
144	PC	0.82	0.827	0.8336	0.8398	0.8442	0.849	0.8536	0.8582	0.8628	0.8676
145	PC	0.835	0.845	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
146	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
147	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
148	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
149	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
150	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
151	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9745	0.9758
152	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
153	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
154	UD	0.15									

PAGE 4

Page 4

HA 52

DRAFT

154	KK	AMC	CNAME	Stplog	havana2.out	
155	KO	0	0	0	22	
156	HC	4				
157	KK	Stplog	CNAME	AEC		
158	KO	0	0	0	22	
159	RS	1	ELEV	484		
160	SV	0	0	2.36	4.76	7.18
161	SV	22.35	24.98	27.64	9.64	12.12
162	SE	484	484.5	485	486	486.5
163	SE	489	489.5	490	487	487.5
164	SO	223.4	7.06	20	36.7	56.5
165	SO	223.4	257.7	293.6	79	103.8
166	SE	484	484.5	485	486	486.5
167	SE	489	489.5	490	487	487.5
168	22				488	488.5

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (--->) DIVERSION OR PUMP FLOW
(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

HA 53

INPUT LINE NO. 6 Pond1 V
38 Pipe1 V
44 Pond2 V
76 Pipe2 V
82 Pond3B V
115 Pipe3 V
121 Pond3
154 ABC
157 Stplog

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1
* FLOOD HYDROGRAPH PACKAGE (HRC-1) *

U.S. ARMY CORPS OF ENGINEERS

Page 5

DRAFT

* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 551-1748 *

havana2.out

* MAY 1991 *
* VERSION 4.0.1E *
* RUN DATE TIME *

5 IO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NNO. 160 NUMBER OF HYDROGRAPH ORIGINATES
NDATE 2JAN94 ENDING DATE
NNOTE 0230 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

* * * * *

6 KK * Pond1 *

7 KO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
Page 6

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havana2.out

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38 KK * * Pipe1 * CNAME C
*****
39 KO OUTPUT CONTROL VARIABLES
      IPRINT 4 PRINT CONTROL
      IPLOT 0 PLOT CONTROL
      QSCAL 0. HYDROGRAPH PLOT SCALE
      IPNCH 0 PUNCH COMPUTED HYDROGRAPH
      IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
      ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
      ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
      TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

40 RS STORAGE ROUTING
      NSTPS 1 NUMBER OF SUBREACHES/
      RSVIC 486.00 INITIAL CONDITION
      X 0.00 WORKING R AND D COEFFICIENT

41 SV STORAGE 0.0 10.5 21.2 31.9 42.8 53.8 65.0 76.2 87.6
42 SE ELEVATION 486.00 486.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00
43 SQ DISCHARGE 0. 9. 26. 48. 74. 103. 136. 171. 209.
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*****
* * Pond2 *
*****
45 KO OUTPUT CONTROL VARIABLES
      IPRINT 4 PRINT CONTROL
      IPLOT 0 PLOT CONTROL
      QSCAL 0. HYDROGRAPH PLOT SCALE
      IPNCH 1 PUNCH COMPUTED HYDROGRAPH
      IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
      ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
      ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
      TIMINT 0.167 TIME INTERVAL IN HOURS

TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

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HYDROGRAPH ROUTING DATA

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TIMINT	0.167	TIME INTERVAL IN HOURS
1	0.167	0.167
2	0.167	0.167
3	0.167	0.167
4	0.167	0.167
5	0.167	0.167
6	0.167	0.167
7	0.167	0.167
8	0.167	0.167
9	0.167	0.167
10	0.167	0.167
11	0.167	0.167
12	0.167	0.167
13	0.167	0.167
14	0.167	0.167
15	0.167	0.167
16	0.167	0.167
17	0.167	0.167
18	0.167	0.167
19	0.167	0.167
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21	0.167	0.167
22	0.167	0.167
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44	0.167	0.167
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87	0.167	0.167
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89	0.167	0.167
90	0.167	0.167
91	0.167	0.167
92	0.167	0.167
93	0.167	0.167
94	0.167	0.167
95	0.167	0.167
96	0.167	0.167
97	0.167	0.167
98	0.167	0.167
99	0.167	0.167
100	0.167	0.167

CARDIN	TIME	STARTING	TIME
JXTIME	0	STARTING	TIME

SUBBASIN RUNOFF DATA

	TAREA,	SUBBASIN AREA
0.07		

RTIOR 1.00000 RECESSION CONSTANT

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Coal Combustion Waste Impoundment
Dam Assessment Report

A-91

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HYDROGRAPH ROUTING DATA

117 RS STORAGE ROUTING
NSTES 1 NUMBER OF SUBREACHES/
RSVRIC 492.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

	STORAGE	0.0	22.2	44.5	67.0	89.6	112.3	135.1	158.0	181.1
118 SV										
119 SE	ELEVATION	492.00	492.50	493.00	493.50	494.00	494.50	495.00	495.50	496.00
120 SQ	DISCHARGE	0.	11.	31.	58.	89.	124.	163.	205.	251.

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*
* Pond3 *
*

122 KO OUTPUT CONTROL VARIABLES

	IPRNT	4	PRINT CONTROL
	IPLOT	0	PLOT CONTROL
	OSCAL	0.	HYDROGRAPH PLOT SCALE
	IPNCH	1	PUNCH COMPUTED HYDROGRAPH
	IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
	ISAV1	1	FIRST ORIGINATE PUNCHED OR SAVED
	ISAV2	160	LAST ORIGINATE PUNCHED OR SAVED
	TIMINT	0.167	TIME INTERVAL IN HOURS

126 IN TIME DATA FOR INPUT TIME SERIES

	JYMIN	6	TIME INTERVAL IN MINUTES
	JXDATE	1JAN94	STARTING DATE
	JXTIME	0	STARTING TIME

SUBBASIN RUNOFF DATA

123 EA SUBBASIN CHARACTERISTICS

	TAREA,	0.01	SUBBASIN AREA

124 BF BASE FLOW CHARACTERISTICS

	STRTQ	0.00	INITIAL FLOW
	QRCN <td>0.00<td>BEGIN BASE FLOW RECESSON</td></td>	0.00 <td>BEGIN BASE FLOW RECESSON</td>	BEGIN BASE FLOW RECESSON
	RTIOR <td>1.00000<td>RECESSON CONSTANT</td></td>	1.00000 <td>RECESSON CONSTANT</td>	RECESSON CONSTANT

PRECIPITATION DATA

125 PB STORM 7.00 BASIN TOTAL PRECIPITATION

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*** **

157 KK * * CNAME ABC
* * Stplot * *
* * * *

158 KO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCALE 0 HYDROGRAPH PLOT SCALE
INCH 0 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2 160 LAST ORDINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

159 RS	STORAGE ROUTING	1 NUMBER OF SUBBRANCHES/ INITIAL CONDITION	ITYP	ELEV TYPE OF INITIAL CONDITION
	NSRVC	484.00		
	RSRVC X	0.00 WORKING K AND D COEFFICIENT		
160 SV	STORAGE	0.0 0.0 2.4 4.8 7.2 9.6 12.1 14.6 17.2 19.7		
162 SE	ELEVATION	484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50		
164 SQ	DISCHARGE	0. 7. 20. 37. 56. 79. 104. 131. 160. 191.		
166 SE	ELEVATION	484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50		

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	2.36	4.76	7.18	9.64	12.12	14.63	17.17	19.75
OUTFLOW	0.00	7.06	20.00	36.70	56.50	79.00	103.80	159.80	190.70
ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00
STORAGE	22.35	24.98	27.64						
OUTFLOW	223.40	257.70	293.60						
ELEVATION	489.00	489.50	490.00						

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
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	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
					6-HOUR	24-HOUR	72-HOUR			
+	HYDROGRAPH AT	Pond1	139.	12.00	19.	7.	6.	0.04		
+	ROUTED TO	Pipe1	8.	13.67	7.	4.	4.	0.04	486.42	13.67
+	HYDROGRAPH AT	Pond2	124.	12.00	17.	6.	5.	0.03		
+	ROUTED TO	Pipe2	19.	12.67	15.	12.	12.	0.03	486.21	12.67
+	HYDROGRAPH AT	Pond3B	291.	12.00	50.	25.	24.	0.07		
+	ROUTED TO	Pipe3	18.	17.50	18.	12.	11.	0.07	492.68	17.50
+	HYDROGRAPH AT	Pond3	32.	12.00	4.	2.	1.	0.01		
+	4 COMBINED AT	ABC	62.	12.00	43.	30.	29.	0.15		
+	ROUTED TO	Stplog	42.	15.17	40.	29.	27.	0.15	485.63	15.17

*** NORMAL END OF HEC-1 ***

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[illegible]

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW. THE DEFINITIONS OF VARIABLES -ETIMP- AND -RTTOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RW-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION. NEW OPTIONS: DAMBREAK-OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS=WRITE SVAGE FREQUENCY, DSS=READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMET INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

PAGE 1

HEC-1 INPUT

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1	ID
2	ID
3	ID
4	*DIAGRAM
5	IT 10 1JAN94 0 160
6	IO 4
7	KK Pondl
8	KK 0
9	BA 0.0358
10	IN 6 1JAN94 0
11	* precipi
12	FC 0 0.001 0.002 0.0031 0.0041 0.0051 0.0062 0.0073 0.0083 0.0094
13	PC 0.0105 0.0116 0.0127 0.0138 0.015 0.0161 0.0173 0.0185 0.0196 0.0208
14	FC 0.022 0.0232 0.0244 0.0257 0.0269 0.0281 0.0294 0.0307 0.0319 0.0332
15	PC 0.0345 0.0358 0.0371 0.0384 0.0398 0.0411 0.0425 0.0438 0.0452 0.0466
16	FC 0.048 0.0494 0.0508 0.0523 0.0538 0.0553 0.0568 0.0583 0.0598 0.0614
17	PC 0.063 0.0646 0.0662 0.0679 0.0696 0.0712 0.073 0.0747 0.0764 0.0782

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17	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.123	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
21	PC	0.161	0.1651	0.1695	0.1741	0.1789	0.1841	0.1895	0.1952	0.2014	0.208
22	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3244	0.3408	0.35679
23	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
24	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
31	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
34	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	PC	1	1	1	1	1	1	1	1	1	1
36	LS	0	100	100							
37	UD	0.15									
38	KK	Pipe1	CNAME	C							
39	KO	0	0	0	0	22					
40	RS	1	ELEV	486	0						
41	SV	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62	
42	SE	486	486.5	487	487.5	488	488.5	489	489.5	490	
43	SQ	0	9.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	
HEC-1 INPUT											
LINE	ID	1	2	3	4	5	6	7	8	9	10
44	KK	Pond2	0	0	1	22					
45	KO	0	0	0	0						
46	BA	0.032									
47	PR	16									
48	IN	6	LAN94	0							
49	* precip1	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
50	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
51	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
52	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
53	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
54	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
55	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
56	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
57	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
58	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
59	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
60	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3244	0.3408	0.35679
61	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
62	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162

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63 PC 0.82 0.8237 0.8273 0.8308 0.8342 0.8376 0.8409 0.8442 0.8474 0.8505
64 PC 0.8535 0.8565 0.8594 0.8622 0.8649 0.8676 0.8702 0.8728 0.8753 0.8777
65 PC 0.88 0.8823 0.8846 0.8868 0.8889 0.8912 0.8934 0.8955 0.8976 0.8997
66 PC 0.9018 0.9038 0.9058 0.9078 0.9098 0.9117 0.9136 0.9155 0.9174 0.9192
67 PC 0.921 0.9228 0.9246 0.9263 0.928 0.9297 0.9314 0.933 0.9346 0.9362
68 PC 0.9377 0.9393 0.9408 0.9423 0.9438 0.9452 0.9466 0.948 0.9494 0.9507
69 PC 0.952 0.9533 0.9546 0.9559 0.9572 0.9584 0.9597 0.961 0.9622 0.9635
70 PC 0.9647 0.966 0.9672 0.9685 0.9697 0.9709 0.9722 0.9734 0.9746 0.9758
71 PC 0.977 0.9782 0.9794 0.9806 0.9818 0.9829 0.9841 0.9853 0.9864 0.9876
72 PC 0.9887 0.9899 0.991 0.9922 0.9933 0.9944 0.9956 0.9967 0.9978 0.9989
73 PC 1 1 1 1 1 1 1 1 1 1
74 LS 0 100 100 100 100 100 100 100 100 100
75 UD 0.15

76 KK Pipe2 CNAME B
77 KO 0 0 0 22
78 RS 1 ELEV 486 0
79 SV 0 9.73 19.54 29.4 39.34 49.34 59.41 69.55 79.75
80 * pond2out
SQ 11.1 31.4 57.7 57.7 57.7 57.7 57.7 57.7 57.7 57.7
81 * pond2elev
SE 486 486.5 487 487.5 488 488.5 489 489.5 490
82 KK Pond3B New proposed ash pond
KO 0 0 0 1 22
83 BA 0.072
84 BF 11.9 0 0
85 PB 16
86 IN 6 1JAN94 0
87 * precipl
88 PC 0 0.001 0.002 0.0031 0.0041 0.0051 0.0062 0.0073 0.0083 0.0094
89 PC 0.0105 0.0116 0.0127 0.0138 0.015 0.0161 0.0173 0.0185 0.0196 0.0208
90 PC 0.022 0.0232 0.0244 0.0257 0.0269 0.0281 0.0294 0.0307 0.0319 0.0332

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HEC-1 INPUT

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
81 PC 0.0345 0.0358 0.0371 0.0384 0.0398 0.0411 0.0425 0.0438 0.0452 0.0466
82 PC 0.048 0.0494 0.0508 0.0523 0.0538 0.0553 0.0568 0.0583 0.0598 0.0614
83 PC 0.063 0.0646 0.0662 0.0679 0.0696 0.0712 0.073 0.0747 0.0764 0.0782
84 PC 0.08 0.0818 0.0836 0.0855 0.0874 0.0892 0.0912 0.0931 0.095 0.097
85 PC 0.099 0.101 0.103 0.1051 0.1072 0.1093 0.1114 0.1135 0.1156 0.1178
86 PC 0.12 0.1223 0.1246 0.1271 0.1296 0.1323 0.135 0.1379 0.1408 0.1439
87 PC 0.147 0.1502 0.1534 0.1566 0.1598 0.163 0.1663 0.1697 0.1733 0.1771
88 PC 0.181 0.1851 0.1895 0.1941 0.1989 0.204 0.2094 0.2152 0.2214 0.228
89 PC 0.235 0.2427 0.2513 0.2609 0.2715 0.283 0.3068 0.3544 0.4308 0.5679
90 PC 0.663 0.682 0.6986 0.713 0.7252 0.735 0.7434 0.7514 0.7588 0.7656
PC 0.772 0.778 0.7836 0.789 0.7942 0.799 0.8036 0.808 0.8122 0.8162
PC 0.82 0.8237 0.8273 0.8308 0.8342 0.8376 0.8409 0.8442 0.8474 0.8505
PC 0.8535 0.8565 0.8594 0.8622 0.8649 0.8676 0.8702 0.8728 0.8753 0.8777
PC 0.88 0.8823 0.8846 0.8868 0.8889 0.8912 0.8934 0.8955 0.8976 0.8997
PC 0.9018 0.9038 0.9058 0.9078 0.9098 0.9117 0.9136 0.9155 0.9174 0.9192
PC 0.921 0.9228 0.9246 0.9263 0.928 0.9297 0.9314 0.933 0.9346 0.9362
PC 0.9377 0.9393 0.9408 0.9423 0.9438 0.9452 0.9466 0.948 0.9494 0.9507
PC 0.952 0.9533 0.9546 0.9559 0.9572 0.9584 0.9597 0.961 0.9622 0.9635

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109	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
112	PC	1	1	1	1	1	1	1	1	1	1
113	LS	0	100	100	100	100	100	100	100	100	100
114	UD	0.15									
115	KK	Pipe3	CNAME	D							
116	KO	0	0	0	0	0	22				
117	RS	1	ELEV	492	0						
118	SV	Pond3Bvol	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.12	
119	* Pond3Belev	492	492.5	493	493.5	494	494.5	495	495.5	496	
120	* Pond3Bout	SQ	0	11.1	31.38	57.66	57.66	57.66	57.66	57.66	57.66
121	KK	Pond3									
122	KO	0	0	0	1	22					
123	BA	0.0083									
124	BF	0	0	0							
125	PB	16									
126	IN	6	1JAN94	0							
127	* precipl	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
128	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
129	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
130	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0423	0.0438	0.0452	0.0466
131	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
132	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
133	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
134	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
135	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
136	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
137	PC	0.181	0.1831	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
138	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
139	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656

HEC-1 INPUT

ID	1	2	3	4	5	6	7	8	9	10
PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
PC	1	1	1	1	1	1	1	1	1	1
LS	0	100	100	100	100	100	100	100	100	100
UD	0.15									

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DRAFT

154	KK	ABC	CNAME	Stplog	Havana3.out
155	KO	0	0	0	22
156	HC	4	0	0	22
157	KK	Stplog	CNAME	ABC	
158	KO	0	0	0	22
159	RS	1	ELEV	484	0
160	SV	0	0	2.36	7.18
161	SV	22.35	24.98	27.64	9.48
162	SE	484	484.5	485	12.12
163	SE	489	489.5	490	14.63
164	SO	0	7.06	20	17.17
165	SO	223.4	257.7	293.6	19.75
166	SE	484	484.5	485	488
167	SE	489	489.5	490	488
168	ZZ				488.5

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE
(V) ROUTING
(V) CONNECTOR
(V) DIVERSION OR PUMP FLOW
(V) RETURN OF DIVERTED OR PUMPED FLOW

6 Pond1
38 Pipel
44 Pond2
76 Pipe2
82 Pond3B
115 Pipe3
121 Pond3
154 ABC
157 Stplog

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *

DRAFT

* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 551-1748 *

Havna3.out

* MAY 1991 *
* VERSION 4.0.1E *
* RUN DATE TIME *

5 IO OUTPUT CONTROL VARIABLES 4 PRINT CONTROL
IPRNT 4
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NQ, 160 NUMBER OF HYDROGRAPH ORDINATES
NDATE 2JAN94 ENDING DATE
NDATE 0230 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

*** **

*
6 XK * Pondl *
*

7 KO OUTPUT CONTROL VARIABLES 4 PRINT CONTROL
IPRNT 4
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH

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HA 70

A-102
Coal Combustion Waste Impoundment
Dam Assessment Report

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學
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HA 71

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38 KK      *
          *
          * Pipel
          *
          *
          *****

```

39	NO	OUTPUT	CONTROL	VARIABLES
		IPRNT	4	PRINT CONTROL
		IPLOT	0	PLOT CONTROL
		QSCAL	0.	HYDROGRAPH PLOT SCALE
		IPNCH	0	PUNCH COMPUTED HYDROGRAPH
		IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
		ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
		ISAV2	160	LAST ORDINATE PUNCHED OR SAVED
		TIME	0.167	TIME INTERVAL IN HOURS
		TINT		

HYDROGRAPH ROUTING DATA

STORAGE ROUTING	1 NUMBER OF SUBREACHES/ INITIAL CONDITION	ITYP	ELEV	TYPE OF INITIAL CONDITION
NSRPS RSVAC X	486.00 0.00 WORKING R AND D COEFFICIENT			
41 SV STORAGE	0.0 10.5 21.2 31.9	42.8	53.8	76.2 87.6
42 SE ELEVATION	486.00 486.50 487.00 487.50	488.00	488.50	489.00 489.50 490.00
43 SQ DISCHARGE	0. 9. 26.	26.	26.	26. 26. 26.

[illegible]

```

** ** ** ** ** ** 
44 KK      *
            * pond2
            *
            *
            *

```

45 NO	OUTPUT CONTROL VARIABLES
	PRINT CONTROL
	4
	PLOT CONTROL
	0.
	HYDROGRAPH PLOT SCALE
	PUNCH COMPUTED HYDROGRAPH
	1
	FIRST HYDROGRAPH ON THIS UNIT
	22
	SAVED ORNATE PUNCHED OR SAVED
	1
	LAST ORNATE PUNCHED OR SAVED
	160
	TIME INTERVAL IN HOURS
	0.167

TIME DATA FOR INPUT TIME SERIES	6	TIME INTERVAL IN MINUTES
JXMIN	1JAN94	STARTING DATE
JXDATE	0	STARTING TIME
JXTIME		

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HAAR

*Coal Combustion Waste Impoundment
Dam Assessment Report*

DRAFT

Havana3.out
22 SAVE HYDROGRAPH ON THIS UNIT
1 FIRST ORIGINATE PUNCHED OR SAVED
160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

78 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	ITYP	ELEV	TYPE OF INITIAL CONDITION
79 SV	STORAGE	0.0 9.7 19.5 29.4	39.3	59.4	69.6 79.7
80 SQ	DISCHARGE	11. 31. 58.	58.	58.	58.
81 SE	ELEVATION	486.00 486.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00			

*** ** ** ** **

* * Pond3B *
* * New Proposed ash pond

83 RO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

87 IN TIME DATA FOR INPUT TIME SERIES
JXIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

84 BA SUBBASIN CHARACTERISTICS
TAREA, 0.07 SUBBASIN AREA

85 BF BASE FLOW CHARACTERISTICS
STRTQ 11.90 INITIAL FLOW
QRCSN 0.00 BEGIN BASE FLOW RECESSION
RTIOR 1.00000 RECESSION CONSTANT

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HA 73

HA 90

PRECIPITATION DATA

86 PB STORM 16.00 BASIN TOTAL PRECIPITATION

88 PI INCREMENTAL PRECIPITATION PATTERN

[illegible][illegible][illegible]

Iteration	0.01	0.01	0.01	0.01
1	0.01	0.01	0.01	0.01
2	0.01	0.01	0.01	0.01
3	0.01	0.01	0.01	0.01
4	0.01	0.01	0.01	0.01
5	0.01	0.01	0.01	0.01
6	0.01	0.01	0.01	0.01
7	0.01	0.01	0.01	0.01
8	0.01	0.01	0.01	0.01
9	0.01	0.01	0.01	0.01
10	0.01	0.01	0.01	0.01
11	0.01	0.01	0.01	0.01
12	0.01	0.01	0.01	0.01
13	0.01	0.01	0.01	0.01
14	0.01	0.01	0.01	0.01
15	0.01	0.01	0.01	0.01
16	0.01	0.01	0.01	0.01
17	0.01	0.01	0.01	0.01
18	0.01	0.01	0.01	0.01
19	0.01	0.01	0.01	0.01
20	0.01	0.01	0.01	0.01
21	0.01	0.01	0.01	0.01
22	0.01	0.01	0.01	0.01
23	0.01	0.01	0.01	0.01
24	0.01	0.01	0.01	0.01
25	0.01	0.01	0.01	0.01
26	0.01	0.01	0.01	0.01
27	0.01	0.01	0.01	0.01
28	0.01	0.01	0.01	0.01
29	0.01	0.01	0.01	0.01
30	0.01	0.01	0.01	0.01
31	0.01	0.01	0.01	0.01
32	0.01	0.01	0.01	0.01
33	0.01	0.01	0.01	0.01
34	0.01	0.01	0.01	0.01
35	0.01	0.01	0.01	0.01
36	0.01	0.01	0.01	0.01
37	0.01	0.01	0.01	0.01
38	0.01	0.01	0.01	0.01
39	0.01	0.01	0.01	0.01
40	0.01	0.01	0.01	0.01
41	0.01	0.01	0.01	0.01
42	0.01	0.01	0.01	0.01
43	0.01	0.01	0.01	0.01
44	0.01	0.01	0.01	0.01
45	0.01	0.01	0.01	0.01
46	0.01	0.01	0.01	0.01
47	0.01	0.01	0.01	0.01
48	0.01	0.01	0.01	0.01
49	0.01	0.01	0.01	0.01
50	0.01	0.01	0.01	0.01
51	0.01	0.01	0.01	0.01
52	0.01	0.01	0.01	0.01
53	0.01	0.01	0.01	0.01
54	0.01	0.01	0.01	0.01
55	0.01	0.01	0.01	0.01
56	0.01	0.01	0.01	0.01
57	0.01	0.01	0.01	0.01
58	0.01	0.01	0.01	0.01
59	0.01	0.01	0.01	0.01
60	0.01	0.01	0.01	0.01
61	0.01	0.01	0.01	0.01
62	0.01	0.01	0.01	0.01
63	0.01	0.01	0.01	0.01
64	0.01	0.01	0.01	0.01
65	0.01	0.01	0.01	0.01
66	0.01	0.01	0.01	0.01
67	0.01	0.01	0.01	0.01
68	0.01	0.01	0.01	0.01
69	0.01	0.01	0.01	0.01
70	0.01	0.01	0.01	0.01
71	0.01	0.01	0.01	0.01
72	0.01	0.01	0.01	0.01
73	0.01	0.01	0.01	0.01
74	0.01			

0.02	0.03	0.19	0.14
0.02	0.01	0.01	0.01
0.01			

[illegible][illegible][illegible][illegible]

13 LS	SCS LOSS RATE	COMPANY
1	0.00	AMERICAN AIR
2	0.00	AMERICAN AIR
3	0.00	AMERICAN AIR
4	0.00	AMERICAN AIR
5	0.00	AMERICAN AIR
6	0.00	AMERICAN AIR
7	0.00	AMERICAN AIR
8	0.00	AMERICAN AIR
9	0.00	AMERICAN AIR
10	0.00	AMERICAN AIR
11	0.00	AMERICAN AIR
12	0.00	AMERICAN AIR
13	0.00	AMERICAN AIR
14	0.00	AMERICAN AIR
15	0.00	AMERICAN AIR
16	0.00	AMERICAN AIR
17	0.00	AMERICAN AIR
18	0.00	AMERICAN AIR
19	0.00	AMERICAN AIR
20	0.00	AMERICAN AIR
21	0.00	AMERICAN AIR
22	0.00	AMERICAN AIR
23	0.00	AMERICAN AIR
24	0.00	AMERICAN AIR
25	0.00	AMERICAN AIR
26	0.00	AMERICAN AIR
27	0.00	AMERICAN AIR
28	0.00	AMERICAN AIR
29	0.00	AMERICAN AIR
30	0.00	AMERICAN AIR
31	0.00	AMERICAN AIR
32	0.00	AMERICAN AIR
33	0.00	AMERICAN AIR
34	0.00	AMERICAN AIR
35	0.00	AMERICAN AIR
36	0.00	AMERICAN AIR
37	0.00	AMERICAN AIR
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86	0.00	AMERICAN AIR
87	0.00	AMERICAN AIR
88	0.00	AMERICAN AIR
89	0.00	AMERICAN AIR
90	0.00	AMERICAN AIR
91	0.00	AMERICAN AIR
92	0.00	AMERICAN AIR
93	0.00	AMERICAN AIR
94	0.00	AMERICAN AIR
95	0.00	AMERICAN AIR
96	0.00	AMERICAN AIR
97	0.00	AMERICAN AIR
98	0.00	AMERICAN AIR
99	0.00	AMERICAN AIR
100	0.00	AMERICAN AIR

CRVNR: 100.00 CURVE NUMBER

TIME	100.00 PERCENT IMPERVIOUS AREA
0.00	0.00
0.05	0.00
0.10	0.00
0.15	0.00
0.20	0.00
0.25	0.00
0.30	0.00
0.35	0.00
0.40	0.00
0.45	0.00
0.50	0.00
0.55	0.00
0.60	0.00
0.65	0.00
0.70	0.00
0.75	0.00
0.80	0.00
0.85	0.00
0.90	0.00
0.95	0.00
1.00	0.00
1.05	0.00
1.10	0.00
1.15	0.00
1.20	0.00
1.25	0.00
1.30	0.00
1.35	0.00
1.40	0.00
1.45	0.00
1.50	0.00
1.55	0.00
1.60	0.00
1.65	0.00
1.70	0.00
1.75	0.00
1.80	0.00
1.85	0.00
1.90	0.00
1.95	0.00
2.00	0.00
2.05	0.00
2.10	0.00
2.15	0.00
2.20	0.00
2.25	0.00
2.30	0.00
2.35	0.00
2.40	0.00
2.45	0.00
2.50	0.00
2.55	0.00
2.60	0.00
2.65	0.00
2.70	0.00
2.75	0.00
2.80	0.00
2.85	0.00
2.90	0.00
2.95	0.00
3.00	0.00
3.05	0.00
3.10	0.00
3.15	0.00
3.20	0.00
3.25	0.00
3.30	0.00
3.35	0.00
3.40	0.00
3.45	0.00
3.50	0.00
3.55	0.00
3.60	0.00
3.65	0.00
3.70	0.00
3.75	0.00
3.80	0.00
3.85	0.00
3.90	0.00
3.95	0.00
4.00	0.00
4.05	0.00
4.10	0.00
4.15	0.00
4.20	0.00
4.25	0.00
4.30	0.00
4.35	0.00
4.40	0.00
4.45	0.00
4.50	0.00
4.55	0.00
4.60	0.00
4.65	0.00
4.70	0.00
4.75	0.00
4.80	0.00
4.85	0.00
4.90	0.00
4.95	0.00
5.00	0.00
5.05	0.00
5.10	0.00
5.15	0.00
5.20	0.00
5.25	0.00
5.30	0.00
5.35	0.00
5.40	0.00
5.45	0.00
5.50	0.00
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5.60	0.00
5.65	0.00
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5.75	0.00
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6.90	0.00
6.95	0.00
7.00	0.00
7.05	0.00
7.10	0.00
7.15	0.00
7.20	0.00
7.25	0.00
7.30	0.00
7.35	0.00
7.40	0.00
7.45	0.00

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14 UD
SCS DIMENSIONLESS UNITGRAPH
TINC 0.15 YAC

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UNIT HYDRO
7 END-OF-PERIOD

122. 109. 33. 10. 3. 1

[illegible]

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5 KK * * pipe3 * CNAME D
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✱✱✱✱✱✱✱✱

6 KO OUTPUT CONTROL VARIABLES

```
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
```

QSCAL 0. HYDROGRAPH PLOT SCALE

22 SAVE HYDROGRAPH ON THIS UNIT

ISAV1	I	FIRST ORIGINATE PUNCHED OR
ISAV2	160	LAST ORIGINATE PUNCHED OR SA

TIMINT 0.167 TIME INTERVAL IN HOURS

Page 1

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Havana3.out

HYDROGRAPH ROUTING DATA

117 RS STORAGE ROUTING
RSTPS 1 NUMBER OF SUBREACHES/
RSVRIC 492.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

118 SV STORAGE 0.0 22.2 44.5 67.0 89.6 112.3 135.1 158.0 181.1

119 SE ELEVATION 492.00 492.50 493.00 493.50 494.00 494.50 495.00 495.50 496.00

120 SQ DISCHARGE 0. 11. 31. 58. 58. 58. 58. 58. 58.

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* Pond3 *
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122 KO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPUNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

126 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

123 BA SUBBASIN CHARACTERISTICS
TAREA, 0.01 SUBBASIN AREA

124 BF BASE FLOW CHARACTERISTICS
STRIC 0.00 INITIAL FLOW
ORCSN 0.00 BEGIN BASE FLOW RECESSON
RTIOR 1.00000 RECESSON CONSTANT

PRECIPITATION DATA

125 PB STORM 16.00 BASIN TOTAL PRECIPITATION

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Havana3.cut

*** **

* * * * *
157 KK * * * * * CNAME ABC
* * * * *

158 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
OSCAL 0 HYDROGRAPH PLOT SCALE
IPNCH 0 PUNCH COMPUTED HYDROGRAPH
ICUT 22 SAME HYDROGRAPH ON THIS UNIT
ISSV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISSV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

	STORAGE ROUTING		1 NUMBER OF SUBREACHES/ INITIAL CONDITION		ITYP	ELEV TYPE OF INITIAL CONDITION	
	RSRFS	RSVRIC	484.00	0.00 WORKING R AND D COEFFICIENT			
159 RS							
160 SV	STORAGE	0.0	0.0	2.4	7.2	12.1	14.6
		22.4	25.0	27.6	9.5	19.7	19.7
162 SE	ELEVATION	484.00	484.50	485.00	486.00	487.00	488.00
		489.00	489.50	490.00	486.50	487.50	488.50
164 SQ	DISCHARGE	0.	7.	20.	37.	56.	79.
		223.	258.	294.	104.	131.	160.
166 SE	ELEVATION	484.00	484.50	485.00	486.00	487.00	488.00
		489.00	489.50	490.00	487.50	488.50	489.50

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.00	2.36	4.76	7.18	9.48	12.12	14.63	17.17	19.75
OUTFLOW	0.00	7.06	20.00	36.70	56.50	79.00	103.80	130.80	159.80	190.70
ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
STORAGE	22.35	24.98	27.64							
OUTFLOW	223.40	237.70	253.60							
ELEVATION	489.00	489.50	490.00							

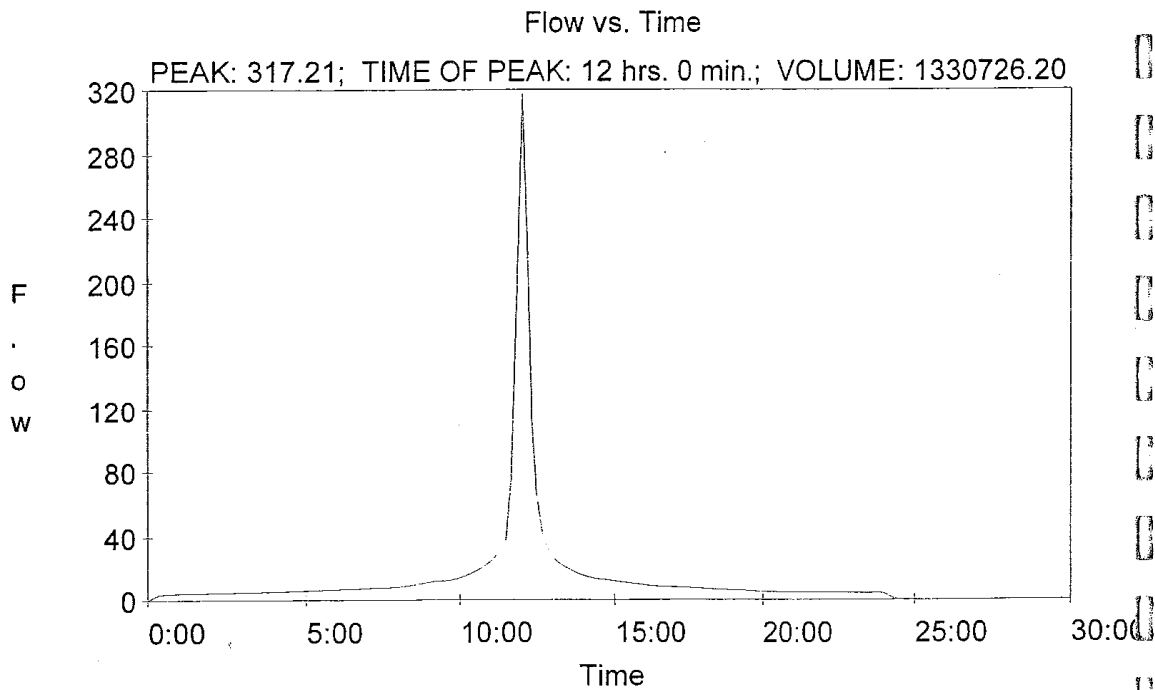
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
Page 14

DRAFT

Havana3.out										
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
					6-HOUR	24-HOUR	72-HOUR			
+	HYDROGRAPH AT	Pond1	317.	12.00	44.	15.	14.	0.04		
+	ROUTED TO	Pipe1	23.	13.17	21.	11.	10.	0.04	486.92	13.17
+	HYDROGRAPH AT	Pond2	284.	12.00	39.	14.	12.	0.03		
+	ROUTED TO	Pipe2	35.	12.67	28.	16.	16.	0.03	486.57	12.67
+	HYDROGRAPH AT	Pond3B	650.	12.00	99.	43.	40.	0.07		
+	ROUTED TO	Pipe3	40.	14.17	39.	24.	22.	0.07	493.17	14.17
+	HYDROGRAPH AT	Pond3	74.	12.00	10.	4.	3.	0.01		
+	4 COMBINED AT	ABC	131.	12.00	95.	54.	50.	0.15		
+	ROUTED TO	Stplog	93.	15.00	87.	51.	47.	0.15	486.78	15.00

*** NORMAL END OF HEC-1 ***

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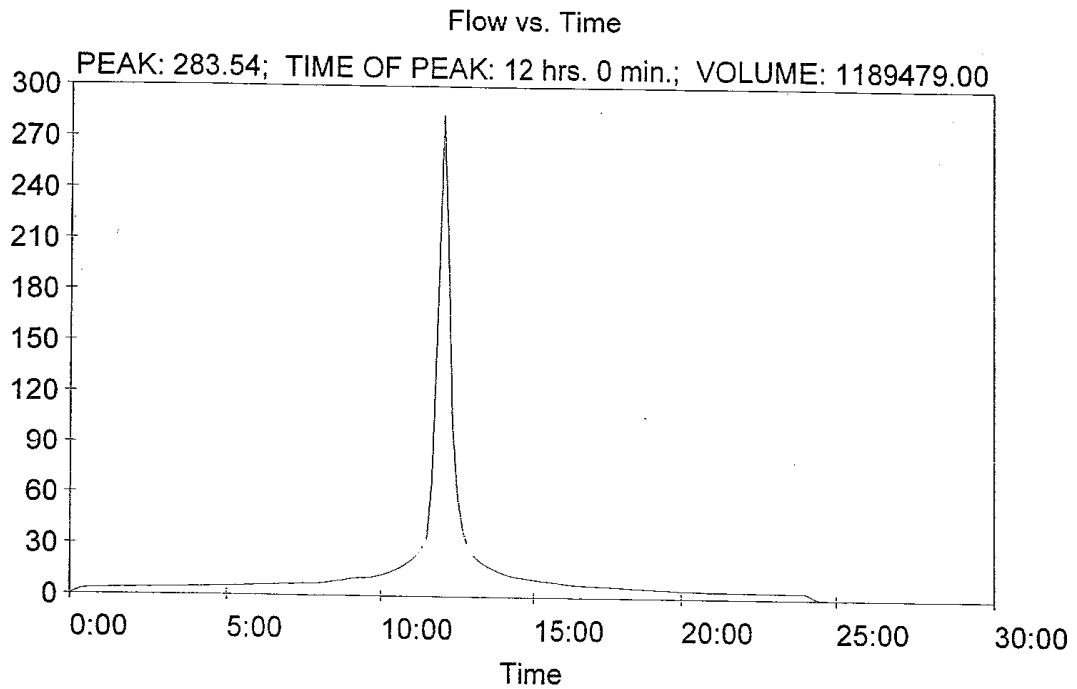


Pond 1 Peak Flow
16" - 1/2 PMP Storm

HA 79

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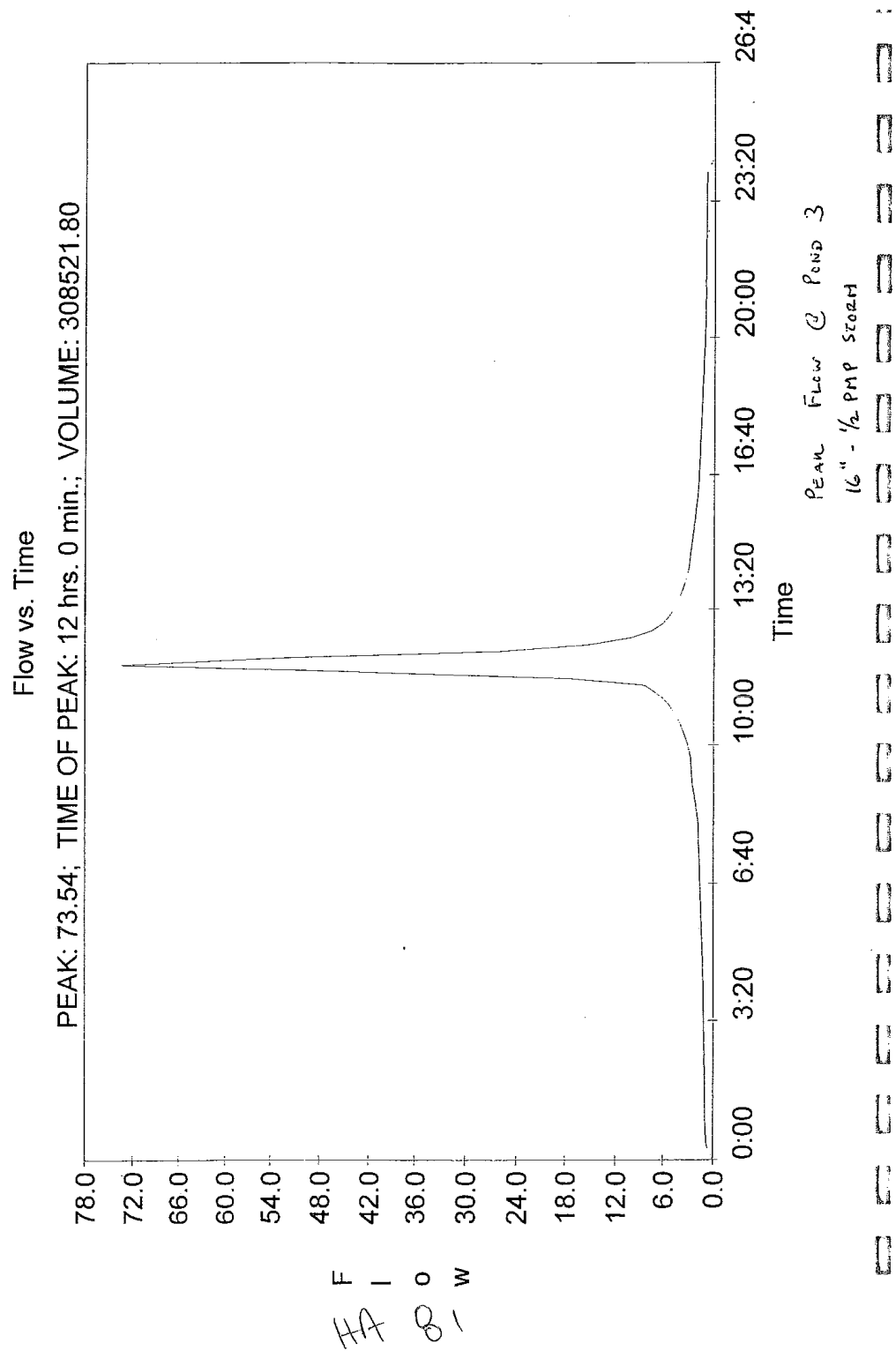
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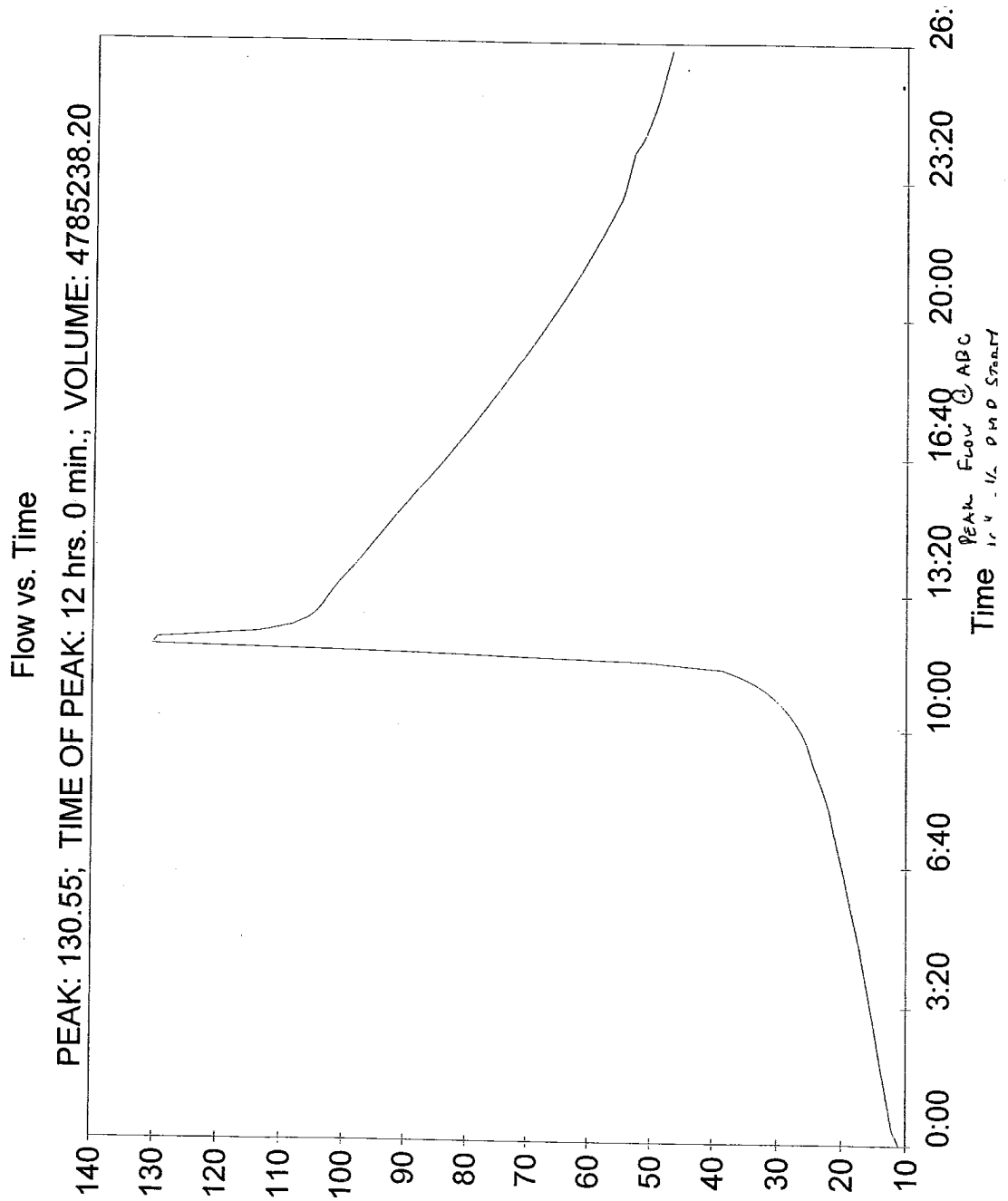
Pond 2 PEAK Flow
16" - 1/2 PMP Storm

HA 88

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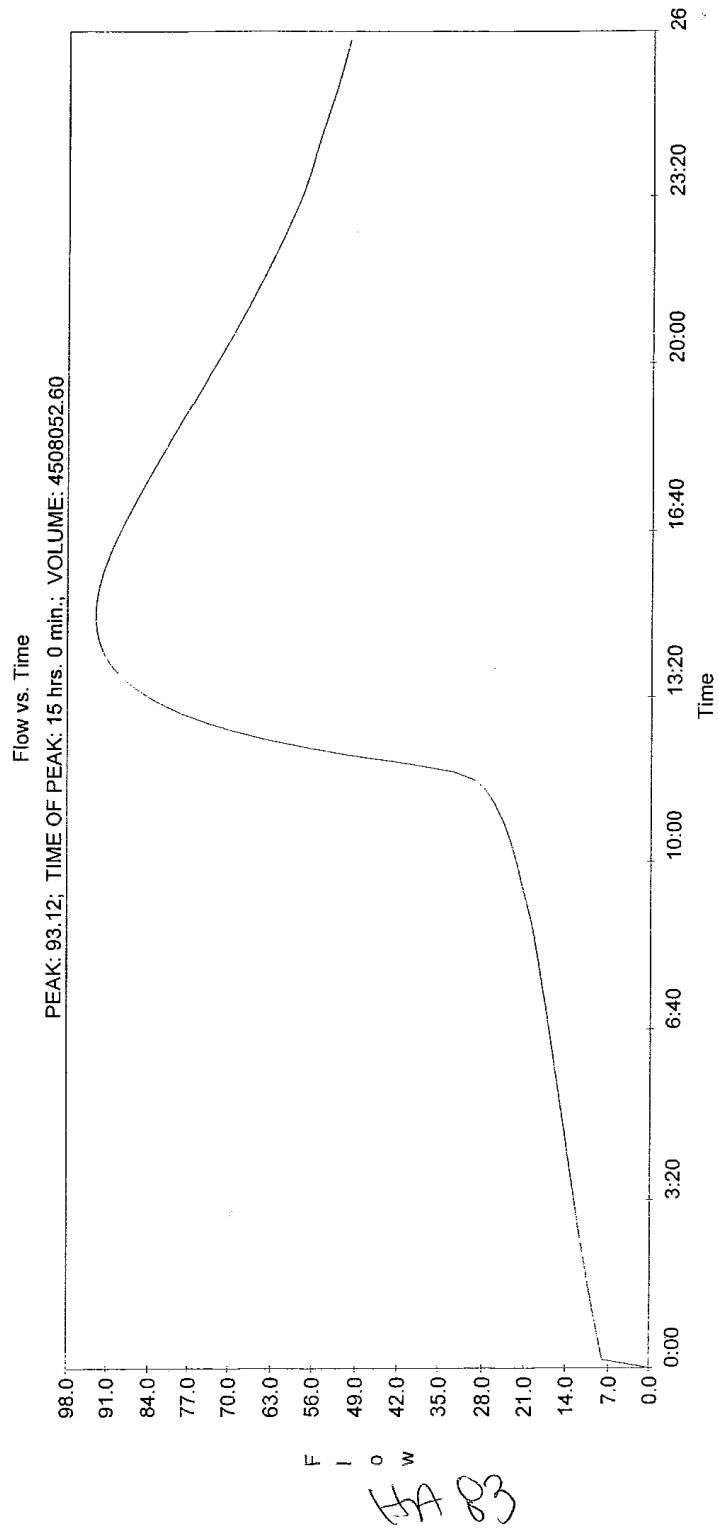


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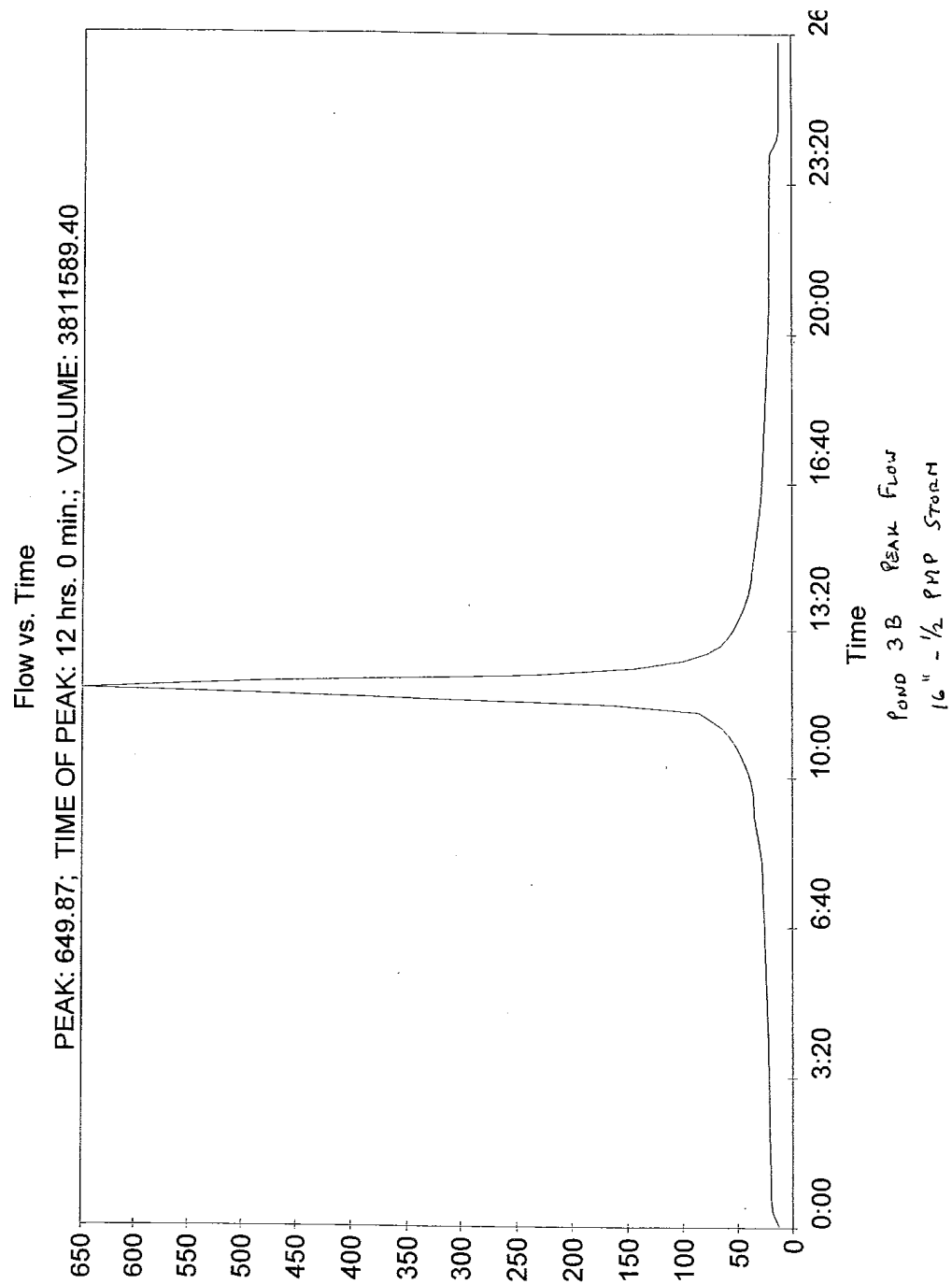


Flow
H.A. 82

DRAFT



DRAFT



Flow
HA07

HA-85

[illegible]

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17	PC	0.08	0.0818	0.0836	0.0855	Havana4, out	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.0874	0.0892	0.0912	0.095	0.097
19	PC	0.12	0.123	0.1246	0.1271	0.1072	0.1093	0.1114	0.1136	0.1178
20	PC	0.147	0.1502	0.1534	0.1566	0.1256	0.1323	0.135	0.1379	0.1439
21	PC	0.181	0.1851	0.1895	0.1941	0.1366	0.143	0.1463	0.1498	0.1571
22	PC	0.235	0.2427	0.2513	0.2609	0.1989	0.204	0.2094	0.2152	0.228
23	PC	0.663	0.682	0.6986	0.713	0.2715	0.283	0.3068	0.3544	0.5679
24	PC	0.772	0.778	0.7836	0.789	0.7252	0.735	0.7434	0.7588	0.7656
25	PC	0.82	0.8237	0.8273	0.8308	0.789	0.799	0.8036	0.808	0.8122
26	PC	0.8535	0.8565	0.8594	0.8622	0.8308	0.8342	0.8376	0.8409	0.8474
27	PC	0.88	0.8823	0.8846	0.8868	0.8622	0.8649	0.8676	0.8702	0.8728
28	PC	0.9018	0.9038	0.9058	0.9078	0.8868	0.8912	0.8934	0.8955	0.8976
29	PC	0.921	0.9228	0.9246	0.9263	0.9078	0.9117	0.9136	0.9155	0.9174
30	PC	0.9377	0.9393	0.9408	0.9423	0.9098	0.912	0.9136	0.9155	0.9174
31	PC	0.952	0.9533	0.9546	0.9559	0.928	0.9297	0.9314	0.933	0.9346
32	PC	0.967	0.968	0.9692	0.9705	0.9438	0.9452	0.9466	0.948	0.9494
33	PC	0.977	0.9782	0.9794	0.9806	0.9572	0.9584	0.9597	0.961	0.9622
34	PC	0.987	0.988	0.989	0.9902	0.9697	0.9709	0.9722	0.9734	0.9746
35	PC	0.997	0.998	0.999	1	0.9823	0.9838	0.9853	0.9864	0.9876
36	LS	1	1	1	1	0.9853	0.9864	0.9876	0.9888	0.9902
37	UD	0.15	0.15	0.15	0.15	0.9922	0.9933	0.9944	0.9956	0.9967
38	KK	Pipel	CNAME	C						
39	KO	0	0	0	0					
40	RS	1	ELEV	486	0					
41	SV	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62
42	SE	486	486.5	487	487.5	488	488.5	489	489.5	490
43	SQ	0	9.25	26.15	48.05	73.97	103.38	135.9	171.25	209.23
LINE	ID	1	2	3	4	5	6	7	8	9
44	KK	Pond2	0	0	1	22				
45	KO	0	0	0	0	0				
46	BA	0.032	0	0	0	0				
47	PA	16	13AN94	0						
48	IN	6	13AN94	0						
49	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196
50	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.032
51	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452
52	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598
53	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.0727	0.0742	0.0758
54	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095
55	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156
56	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408
57	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733
58	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.228
59	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.5679
60	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7588	0.7656
61	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122
62	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8474	0.8505

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63 FC 0.82 0.8237 0.8273 0.9308 Havana4.out 0.8442 0.8376 0.8409 0.8442 0.8474 0.8505
64 FC 0.8535 0.8565 0.8594 0.8622 0.8649 0.8676 0.8702 0.8728 0.8753 0.8777
65 FC 0.88 0.8823 0.8846 0.8868 0.889 0.8912 0.8934 0.8955 0.8976 0.8997
66 FC 0.9018 0.9038 0.9058 0.9078 0.9098 0.9117 0.9136 0.9155 0.9174 0.9192
67 FC 0.921 0.9228 0.9246 0.9263 0.928 0.9297 0.9314 0.933 0.9346 0.9362
68 FC 0.9377 0.9393 0.9408 0.9423 0.9438 0.9452 0.9466 0.9484 0.9507
69 FC 0.952 0.9533 0.9546 0.9559 0.9572 0.9584 0.9597 0.961 0.9622 0.9635
70 FC 0.9647 0.966 0.9672 0.9685 0.9697 0.9709 0.9722 0.9734 0.9746 0.9758
71 FC 0.977 0.9782 0.9794 0.9806 0.9818 0.9829 0.9841 0.9853 0.9864 0.9876
72 FC 0.9887 0.9899 0.991 0.9922 0.9933 0.9944 0.9956 0.9967 0.9978 0.9989
73 LS 1 1 100 1
74 LS 0 100 100
75 UD 0.15

76 KK Pipe2 CNAME B 0 22
77 KO 0 0
78 RS 1 ELEV 486 0
79 sv Pond2vol 0 9.73 19.54 29.4 39.34 49.34 59.41 69.55 79.75
80 SQ Pond2out 0 31.38 57.66 88.77 124.06 163.08 205.5 251.08 299.59
81 SE Pond2elev 486 486.5 487 487.5 488 488.5 489 489.5 490
82 KK Pond3B New proposed ash pond 1 22
83 KO 0 0
84 BA 0.072
85 BF 11.9 0 0
86 PB 16
87 IN 6 1JAN94 0

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HEC-1 INPUT

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
91 FC 0.0345 0.0358 0.0371 0.0384 0.0398 0.0411 0.0425 0.0438 0.0452 0.0466
92 FC 0.048 0.0494 0.0508 0.0523 0.0538 0.0553 0.0568 0.0583 0.0598 0.0614
93 FC 0.063 0.0646 0.0662 0.0679 0.0696 0.0712 0.073 0.0747 0.0764 0.0782
94 FC 0.08 0.0818 0.0836 0.0855 0.0874 0.0892 0.0912 0.0931 0.095 0.097
95 FC 0.099 0.101 0.103 0.1051 0.1072 0.1093 0.1114 0.1135 0.1156 0.1178
96 FC 0.12 0.1223 0.1246 0.1271 0.1296 0.1323 0.135 0.1379 0.1408 0.1439
97 FC 0.147 0.1502 0.1534 0.1566 0.1598 0.163 0.1663 0.1697 0.1733 0.1771
98 FC 0.181 0.1851 0.1895 0.1941 0.1989 0.204 0.2094 0.2152 0.2214 0.228
99 FC 0.235 0.2427 0.2513 0.2609 0.2715 0.283 0.3068 0.3344 0.4308 0.5679
100 FC 0.663 0.662 0.6986 0.713 0.7352 0.735 0.7434 0.7514 0.7588 0.7656
101 FC 0.772 0.778 0.7836 0.789 0.7942 0.799 0.8036 0.808 0.8122 0.8162
102 FC 0.82 0.8237 0.8273 0.8308 0.8342 0.8376 0.8409 0.8442 0.8474 0.8505
103 FC 0.8535 0.8565 0.8594 0.8622 0.8649 0.8676 0.8702 0.8728 0.8753 0.8777
104 FC 0.88 0.8823 0.8846 0.8868 0.889 0.8912 0.8934 0.8955 0.8976 0.8997
105 FC 0.9018 0.9038 0.9058 0.9078 0.9098 0.9117 0.9136 0.9155 0.9174 0.9192
106 FC 0.921 0.9228 0.9246 0.9263 0.928 0.9297 0.9314 0.933 0.9346 0.9362
107 FC 0.9377 0.9393 0.9408 0.9423 0.9438 0.9452 0.9466 0.9484 0.9494 0.9507
108 FC 0.952 0.9533 0.9546 0.9559 0.9572 0.9584 0.9597 0.961 0.9622 0.9635

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109	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
112	PC	1	1	1	1	1	1	1	1	1	1
113	LS	0	100	100							
114	UD	0.15									
115	KK	Pipe3	CNAME	D							
116	KO	0	0	0	0	22					
117	RS	1	ELEV	492	0						
118	SV	* Pond3Bvol	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.12	
119	SE	* Pond3Belev	492	493	493.5	494	494.5	495	495.5	496	
120	SQ	* Pond3Bout	0	11.1	31.38	57.66	88.77	124.06	163.08	205.5	251.08
121	KK	Pond3									
122	KO	0	0	0	1	22					
123	BA	0.0083									
124	BF	0	0	0							
125	PB	16									
126	IN	* Precip1	6	1JAN94	0						
127	PC	0.001	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
128	PC	0.0105	0.0115	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
129	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
130	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
131	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
132	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
133	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
134	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
135	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
136	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
137	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
138	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
139	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
140	LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10									
141	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
142	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
143	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
144	PC	0.88	0.8823	0.8846	0.8868	0.8889	0.8912	0.8934	0.8955	0.8976	0.8997
145	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
146	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
147	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
148	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
149	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
150	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
151	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
152	LS	1	1	1	1	1	1	1	1	1	1
153	UD	0.15	100	100							

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HA 000

* MAY 1991 *
* VERSION 4.0.1E *
* RUN DATE TIME *

Havana4.out
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 551-1748 *

5 IO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NNIN 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NQ 160 NUMBER OF HYDROGRAPH ORDINATES
NDATE 2JAN94 ENDING DATE
NDTIME 0230 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

* *
6 KK * Pond1 *
* *

7 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IFNCH 1 PUNCH COMPUTED HYDROGRAPH
Page 6

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Page 7

HAQ2

*Havana Power Plant
Dynegy Midwest Generation, Inc.
Havana, IL*

HA 93

DRAFT

78 RS IOUT 22 SAVE HYDROGRAPH ON THIS UNIT Havana4.out
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

STORAGE ROUTING	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION	ITYP	ELEV	TYPE OF INITIAL CONDITION
NSIPS	0.00 WORKING A AND D COEFFICIENT			
RSVRIC X				
79 SV STORAGE	0.0 9.7 19.5 29.4 39.3 49.3 59.4 69.6 79.7			
80 SQ DISCHARGE	11. 31. 58. 89. 124. 163. 205. 251. 300.			
81 SE ELEVATION	486.00 486.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00			

82 KK * Pond3B * New proposed ash pond

83 KO OUTPUT CONTROL VARIABLES

IPRNT	4	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	1	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORIGINATE PUNCHED OR SAVED
ISAV2	160	LAST ORIGINATE PUNCHED OR SAVED
TIMINT	0.167	TIME INTERVAL IN HOURS

87 IN TIME DATA FOR INPUT TIME SERIES

JXMIN	6	TIME INTERVAL IN MINUTES
JXDATE	1JAN94	STARTING DATE
JXTIME	0	STARTING TIME

SUBBASIN RUNOFF DATA

84 BA SUBBASIN CHARACTERISTICS

TAREA,	0.07	SUBBASIN AREA
--------	------	---------------

85 BF BASE FLOW CHARACTERISTICS

STRQ	11.90	INITIAL FLOW
ORCSN	0.00	BEGIN BASE FLOW RECESSON
RTIOR	1.00000	RECESSON CONSTANT

HA 95

Havana4.out

HYDROGRAPH ROUTING DATA

117 RS STORAGE ROUTING
NSTPS
RSVRIC 492.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

118 SV STORAGE 0.0 22.2 44.5 67.0 89.6 112.3 135.1 158.0 181.1

119 SE ELEVATION 492.00 492.50 493.00 493.50 494.00 494.50 495.00 495.50 496.00

120 SQ DISCHARGE 0. 11. 31. 58. 89. 124. 163. 205. 251.

*** **

121 KK *****
* * Pond3 *
* *

122 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLNT 0 PLOT CONTROL
OSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

126 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

123 BA SUBBASIN CHARACTERISTICS
TAREA, 0.01 SUBBASIN AREA

124 BF BASE FLOW CHARACTERISTICS
STWFO 0.00 INITIAL FLOW
ORCSN 0.00 BEGIN BASE FLOW RECESSON
RTIOR 1.00000 RECESSON CONSTANT

PRECIPITATION DATA

125 PB STORM 16.00 BASIN TOTAL PRECIPITATION

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*** **

157 KK * * Stplog * * CNAME ABC

158 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
OSCAL 0 HYDROGRAPH PLOT SCALE
IPNCH 0 PUNCH COMPUTED HYDROGRAPH
ICUT 22 SAVE HYDROGRAPH CUT-THRESHOLD UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

159 RS	STORAGE ROUTING		1 NUMBER OF SUBREACHES/ INITIAL CONDITION		ITYP	ELEV TYPE OF INITIAL CONDITION	
	NSTPS	484.00	484.00	0.00		WORKING R AND D COEFFICIENT	
160 SV	STORAGE	0.0	22.4	0.0	2.4	27.6	4.8
162 SE	ELEVATION	484.00	489.00	484.50	485.00	486.00	487.00
164 SQ	DISCHARGE	0.0	223.0	7.0	20.0	294.0	37.0
166 SE	ELEVATION	484.00	489.00	484.50	485.00	486.00	487.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.00	2.36	4.76	7.18	9.64	12.12	14.63	17.17	19.75
OUTFLOW	0.00	7.06	20.00	36.70	56.50	79.00	103.80	130.80	159.80	190.70
ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
STORAGE	22.35	24.98	27.64							
OUTFLOW	223.40	257.70	293.60							
ELEVATION	489.00	489.50	490.00							

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
Page 14

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Havana4.out									
OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
+	HYDROGRAPH AT Pond1	317.	12.00	44.	15.	14.	0.04		
+	ROUTED TO Pipe1	23.	13.17	21.	11.	10.	0.04	486.92	13.17
+	HYDROGRAPH AT Pond2	284.	12.00	39.	14.	12.	0.03		
+	ROUTED TO Pipe2	35.	12.67	28.	16.	16.	0.03	486.57	12.67
+	HYDROGRAPH AT Pond3B	650.	12.00	99.	43.	40.	0.07		
+	ROUTED TO Pipe3	40.	14.17	39.	24.	22.	0.07	493.17	14.17
+	HYDROGRAPH AT Pond3	74.	12.00	10.	4.	3.	0.01		
+	4 COMBINED AT ABC	131.	12.00	95.	54.	50.	0.15		
+	ROUTED TO Stplog	93.	15.00	87.	51.	47.	0.15	486.79	15.00

*** NORMAL END OF HEC-1 ***

HA ~~100~~

Havana5.out

0.5 ppm using 21 @ Polishing Pond
5. WFL @ Discharge @ Pond 1, 2 & 3B

[illegible]

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HECIGS, HEC1DB, AND HEC1KW. THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBSEQUENCE, SINGLE EVENT DAMAGE CALCULATION, DSS-WRITE STAGE FREQUENCY, DSS-READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE-GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

PAGE 1

HEC-1 INPUT

LINE	1	2	3	4	5	6	7	8	9	10
ID	.....1	.....2	.....3	.....4	.....5	.....6	.....7	.....8	.....9	.....10
ID										
ID										
ID										
*DIAGRAM										
IT	10	1JAN94	0	160						
IO	4									
KK	Pondl									
KO	0	0	0	1	22					
BA	0.0358									
PB	16									
IN	16	1JAN94	0							
IN	precip1									
PC	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
PC	0.0136	0.0136	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
PC	0.0105	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
PC	0.022	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0466
PC	0.0345	0.0498	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.0727	0.0747	0.0764	0.0782
PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.0727	0.0747	0.0764	0.0782

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17	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
21	PC	0.161	0.1651	0.1695	0.1741	0.1789	0.183	0.1879	0.1928	0.1979	0.203
22	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.294	0.3068	0.314	0.328
23	PC	0.663	0.662	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
24	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
31	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
34	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	PC	1	1	1	1	1	1	1	1	1	1
36	LS	0	0	100	100	100	100	100	100	100	100
37	UD	0.15									
38	KK	Pipel	CNAME	C							
39	RS	0	0	0	0	22					
40	RS	1	ELEV	486	0						
41	Sv	pondlv	10.53	21.17	31.94	42.84	53.85	64.99	76.24	87.62	
42	Sv	pondlv	486	486.5	487	487.5	488	488.5	489	489.5	490
43	SQ	0	9.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
HEC-1 INPUT											
LINE	ID	1	2	3	4	5	6	7	8	9	10
44	KK	Pond2	0	0	0	1	22				
45	KO	0									
46	BA	0.032									
47	PA	16	1JAN94	0							
48	IN	16									
49	PC	precip1	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083
50	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
51	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
52	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
53	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
54	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
55	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
56	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
57	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
58	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
59	PC	0.161	0.1651	0.1695	0.1741	0.1789	0.183	0.1879	0.1928	0.1979	0.203
60	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.294	0.3068	0.314	0.328
61	PC	0.663	0.662	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
62	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162

PAGE 2

HA 101

HA 102

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109	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
112	PC	1	1	1	1	1	1	1	1	1	1
113	LS	0	100	100							
114	UD	0.15									
115	KK	Pipe3	CNAME	D							
116	KO	0	0	0	0	22					
117	RS	1	ELEV	492	0						
118	SV	0	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.12	
119	SE	492	492.5	493	493.5	494	494.5	495	495.5	496	
120	SQ	0	11.1	31.38	57.66	57.66	57.66	57.66	57.66	57.66	
121	KK	Pond3									
122	KO	0	0	0	1	22					
123	BA	0.0083									
124	BF	0	0	0							
125	PB	16									
126	IN	6	1JAN94	0							
127	PC	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094	
128	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
129	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
130	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
131	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
132	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
133	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
134	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
135	PC	0.12	0.1233	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
136	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
137	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
138	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
139	PC	0.663	0.662	0.6966	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656

HA 103

PAGE 4

HEC-1 INEUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
140	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
141	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
142	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
143	PC	0.88	0.8823	0.8846	0.8868	0.8889	0.8912	0.8934	0.8955	0.8976	0.8997
144	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
145	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
146	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
147	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
148	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
149	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
150	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
151	PC	1	1	1	1	1	1	1	1	1	1
152	LS	0	100	100							
153	UD	0.15									

Page 4

154	KK	ABC	CNAME	Stplog	Havana5.out
155	KC	0	0	0	22
156	HC	4			
157	KK	Stplog	CNAME	ABC	
158	KC	0	0	0	22
159	RS	1	ELEV	484	0
160	SV	0	0	2.36	7.18
161	SV	22.35	24.98	27.64	12.12
162	SE	484	484.5	485	9.64
163	SE	489	489.5	490	14.63
164	SQ	186.15	210.47	234.92	17.17
165	SE	484	484.5	485	19.75
166	SE	489	489.5	490	488
167	SE	489	489.5	490	488.5
168	ZZ				162.12

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE
(V) ROUTING
(--->) DIVERSION OR PUMP FLOW
(.) CONNECTOR
(<---) RETURN OF DIVERTED OR PUMPED FLOW

6 Pond1
V
38 Pipe1
44 Pond2
V
76 Pipe2
82 Pond3B
V
115 Pipe3
121 Pond3
154 ABC
V
157 Stplog

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *

* U.S. ARMY CORPS OF ENGINEERS *

DRAFT

Havana5.out

MAY 1991
VERSION 4.0.1E
TIME
RUN DATE

HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 551-1748

5 IO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
IPSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NQ 160 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 2JAN94 ENDING DATE
NDTIME 0230 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRES-Feet
STORAGE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

6 KK
Pond1

7 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
IPSCAL 0. HYDROGRAPH PLOT SCALE
IPUNCH 1 PUNCH COMPUTED HYDROGRAPH

Page 6

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A-138

HA 107

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HA 100

SUBBASIN RUNOFF DATA

46 BA

SUBBASIN CHARACTERISTICS

SUBBASIN CHARACTERISTICS

TAREA, 0.03 SUBBASIN AREA

PRECIPITATION DATA

47 PB

STORM 16.00 BASIN TOTAL PRECIPITATION

49 PI

INCREMENTAL PRECIPITATION PATTERN

[illegible]

74 LS

SCS LOSS RATE

0.00 INITIAL ABSTRACTION
STRTL

0.00 INITIAL ABSTRA
STRTL

0.00 INITIAL ABSTRACTION

CRVNR	100.00	CURVE NUMBER
CRVNR	100.00	CURVE NUMBER

CURVE NUMBER	PERCENT IMPERVIOUS AREA
100.00	100.00
RTMP	

75 UD

SCS DIMENSIONLESS UNITGRAPH

TLAG	0.15	LAG
------	------	-----

水

UNIT HYDROGRAPH
7 END-OF-PERIOD ORDINATES

[illegible]

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** ** ** ** ** *
*      *      *
*      pipe2   *
*      *      *
76 KK          *

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77 KO OUTPUT CONTROL VARIABLES

CONTROL VARIABLES	
IPRNT	4 PRINT CONTROL

IPLOT	0	PLOT CONTROL
1	1	1
2	1	1
3	1	1
4	1	1
5	1	1
6	1	1
7	1	1
8	1	1
9	1	1
10	1	1
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99	1	1
100	1	1

QSCAL 0. HYDROGRAPH PLO

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DRAFT

Havana5.out
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

78 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION	ITVP	ELEV	TYPE OF INITIAL CONDITION
	NSRFS	0.00 WORKING R AND D COEFFICIENT			
	RSVRIC X				
79 SV	STORAGE	0.0 10.5 21.2 31.9 42.8 53.8 65.0 76.2 87.6			
80 SQ	DISCHARGE	11. 31. 58. 58. 58. 58. 58. 58. 58.			
81 SE	ELEVATION	486.00 466.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00			

82 KK * Pond3B * New proposed ash pond

83 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
OSCAL 0. HYDROGRAPH PLOT SCALE
INCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

87 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

84 BA SUBBASIN CHARACTERISTICS
TAREA, 0.07 SUBBASIN AREA
85 BF BASE FLOW CHARACTERISTICS
SRTQ 11.90 INITIAL FLOW
QRCN 0.00 BEGIN BASE FLOW RECESSON
RTIOR 1.00000 RECESSON CONSTANT

HA ~~110~~ 110

DRAFT

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Havana5.out

HYDROGRAPH ROUTING DATA
117 RS  STORAGE ROUTING
        NSTPS      1 NUMBER OF SUBREACHES/
        RSVRIC      492.00 INITIAL CONDITION
        X           0.00 WORKING R AND D COEFFICIENT
118 SV   STORAGE      0.0  22.2  44.5  67.0  89.6  112.3  135.1  158.0  181.1
119 SE   ELEVATION    492.00  492.50  493.00  493.50  494.00  494.50  495.00  495.50  496.00
120 SQ   DISCHARGE     0.    11.    31.    58.    58.    58.    58.    58.    58.
***
*** ***** ** ** ** ** ** ***** ** ** ** ***** ** ** ** ***** ** ** ** ***** ** ** ** *****
*****
*
* Pond3 *
*
*****
122 KO   OUTPUT CONTROL VARIABLES
        IPRTI      4 PRINT CONTROL
        IPLOT      0 PLOT CONTROL
        QSCAL      0. HYDROGRAPH PLOT SCALE
        IPNCH      1 PUNCH COMPUTED HYDROGRAPH
        IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
        ISAV1      1 FIRST ORIGINATE PUNCHED OR SAVED
        ISAV2      160 LAST ORIGINATE PUNCHED OR SAVED
        TIMINT     0.167 TIME INTERVAL IN HOURS

126 IN   TIME DATA FOR INPUT TIME SERIES
        JXMIN      6 TIME INTERVAL IN MINUTES
        JXDATE     1JAN94 STARTING DATE
        JXTIME      0 STARTING TIME

        SUBBASIN RUNOFF DATA
        SUBBASIN CHARACTERISTICS
        TAREA,     0.01 SUBBASIN AREA

124 BF   BASE FLOW CHARACTERISTICS
        STRTQ      0.00 INITIAL FLOW
        QRCN       0.00 BEGIN BASE FLOW RECESSON
        RTIOR      1.00000 RECESSON CONSTANT

        PRECIPITATION DATA
        STORM      16.00 BASIN TOTAL PRECIPITATION

125 PB
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Havana5.out

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*** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
*****
* * * * *
* * Stplog * * CNAME ABC
* * * * *
*****

157 KK
*****

158 KO
*****
OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 0 PUNCH COMPUTED HYDROGRAPH
ICUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2 160 LAST ORDINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

159 RS
*****
STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES/
484.00 INITIAL CONDITION
RSVRC X 0.00 WORKING R AND D COEFFICIENT

160 SV
*****
STORAGE
0.0 0.0 2.4 4.8 7.2 9.6 12.1 14.6 17.2 19.7
22.4 25.0 27.6

162 SE
*****
ELEVATION
484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50
489.00 489.50 490.00

164 SQ
*****
DISCHARGE
0. 7. 19. 35. 53. 72. 93. 116. 139. 162.
186. 210. 235.

166 SE
*****
ELEVATION
484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50
489.00 489.50 490.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE 0.00 0.00 2.36 4.76 7.18 9.64 12.12 14.63 17.17 19.75
OUTFLOW 0.00 6.95 19.31 34.87 52.74 72.40 93.44 115.56 138.53 162.12
ELEVATION 484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50

STORAGE 22.35 24.98 27.64
OUTFLOW 186.15 210.47 234.92
ELEVATION 489.00 489.50 490.00

***

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
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Havana5.out									
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE
					6-HOUR	24-HOUR	72-HOUR		
+	HYDROGRAPH AT	Pond1	317.	12.00	44.	15.	14.	0.04	
+	ROUTED TO	Pipe1	23.	13.17	21.	11.	10.	0.04	486.92
+	HYDROGRAPH AT	Pond2	284.	12.00	39.	14.	12.	0.03	
+	ROUTED TO	Pipe2	33.	12.83	27.	16.	16.	0.03	486.54
+	HYDROGRAPH AT	Pond3B	650.	12.00	99.	43.	40.	0.07	
+	ROUTED TO	Pipe3	40.	14.17	39.	24.	22.	0.07	493.17
+	HYDROGRAPH AT	Pond3	74.	12.00	10.	4.	3.	0.01	
+	4 COMBINED AT	ABC	130.	12.00	94.	54.	50.	0.15	
+	ROUTED TO	Stplog	91.	15.33	86.	51.	47.	0.15	486.93
+									15.33

*** NORMAL END OF HEC-1 ***

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17	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
21	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
22	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5479
23	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
24	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9153	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9465	0.9478	0.9491	0.9505
31	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9865	0.9876
34	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	PC	1	1	1	1	1	1	1	1	1	1
36	LS	0	100	100							
37	UD	0.15									
38	KK	Pipel	CNAME	C							
39	KO	0	0	0	0	22					
40	RS	1	ELEV	486	0						
41	SV	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62	
42	SE	486	486.5	487	487.5	488	488.5	489	489.5	490	
43	SQ	0	9.25	26.15	48.05	73.97	103.38	135.9	171.25	209.23	
LINE	ID	1	2	3	4	5	6	7	8	9	10
44	KK	Fond2	0	0	1	22					
45	KO	0									
46	BA	0.032									
47	FB	16	1JEN94	0							
48	IN	Precip1	0								
49	PC	0.001	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
50	PC	0.0105	0.0116	0.0127	0.0139	0.015	0.0161	0.0173	0.0185	0.0197	0.0209
51	PC	0.022	0.0226	0.0234	0.0243	0.0253	0.0263	0.0273	0.0283	0.0293	0.0303
52	PC	0.0348	0.0354	0.0361	0.0369	0.0378	0.0387	0.0395	0.0404	0.0412	0.042
53	PC	0.048	0.0494	0.0508	0.0523	0.0539	0.0553	0.0568	0.0583	0.0598	0.0614
54	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.0727	0.0742	0.0758	0.0774
55	PC	0.068	0.0696	0.0712	0.0729	0.0745	0.0762	0.0777	0.0793	0.0808	0.0824
56	PC	0.098	0.0991	0.1003	0.1015	0.1027	0.1039	0.1051	0.1063	0.1075	0.1087
57	PC	0.112	0.1123	0.1126	0.1129	0.1132	0.1135	0.1138	0.1141	0.1144	0.1147
58	PC	0.147	0.1502	0.1536	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
59	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
60	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5479
61	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656
62	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162

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109	PC	0.9647	0.966	0.9672	0.9685	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.9777	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9876
111	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9989
112	PC	1	1	1	1	1				
113	LS	0	100	100						
114	UD	0.15								
115	KK	Pipe3	CNAME	D						
116	KO	0	0	0	0	22				
117	RS	1	ELEV	492	0					
118	SV	0	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.12
119	SE	482	492.5	493	493.5	494	494.5	495	495.5	496
120	SQ	0	11.1	31.38	57.66	88.77	124.06	163.08	205.5	251.08
121	KK	Pond3								
122	KO	0	0	0	1	22				
123	BA	0.0083								
124	BF	0	0	0						
125	FB	16								
126	IN	6	1JAN94	0						
127	PC	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083
128	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196
129	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319
130	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452
131	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598
132	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764
133	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095
134	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156
135	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408
136	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733
137	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214
138	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308
139	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588
140	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122
141	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474
142	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753
143	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976
144	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174
145	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346
146	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494
147	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622
148	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746
149	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864
150	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978
151	PC	1	1	1	1	1				
152	LS	0	100	100						
153	UD	0.15								

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HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
140	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
141	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
142	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
143	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
144	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
145	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
146	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
147	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
148	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
149	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
150	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
151	PC	1	1	1	1	1					
152	LS	0	100	100							
153	UD	0.15									

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		Havana6.out	
KK	ABC	CNAME	Stplog
154	0	0	0
155	0	0	22
156	4		
KK	Stplog	CNAME	ABC
157	0	0	0
158	0	0	22
159	1	ELEV	484
Pond3vol			
160	0	0	2.36
161	22.35	24.98	27.64
Pondelv			
162	484	484.5	485
163	489	489.5	490
Pond3out			
164	0	6.95	19.31
165	186.15	210.47	234.92
Pondelv			
166	484	484.5	485
167	489	489.5	490
168	22		

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT (V) ROUTING {--->} DIVERSION OR PUMP FLOW
LINE (.) CONNECTOR {<---} RETURN OF DIVERTED OR PUMPED FLOW

6 Pond1
V
V
38 Pipe1
.
.
44 Pond2
V
V
76 Pipe2
.
.
82 Pond3B
V
V
115 Pipe3
.
.
121 Pond3
.
.
154 ABC.....
V
V
157 Stplog

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

* FLOOD HYDROGRAPH PACKAGE (HEC-1) *

DRAFT

HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 551-1748

Havana6.out

MAY 1991
VERSION 4.0.1E
RUN DATE TIME

5 IO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NNIN 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NQ 160 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 2JAN94
NDTIME 0230 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRES
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

6 KK *****
Pond1 *****

7 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH

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[illegible]

HA 006
122

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* * * * *
38 KK * Pipe1 * C
* * * * *
*****

```

39	NO	OUTPUT CONTROL VARIABLES
	4	PRINT CONTROL
	0	PLOT CONTROL
	0	HYDROGRAPH PLOT SCALE
	0	PUNCH COMPUTED HYDROGRAPH
	22	SAVE HYDROGRAPH ON THIS UNIT
	160	LAST ORIGINATE PUNCHED OR SAVED
	0.167	TIME INTERVAL IN HOURS
		TIMINT

HYDROGRAPH ROUTING DATA

40 RS	STORAGE ROUTING	1 NUMBER OF SUBRENTCHES/ 486.00 INITIAL CONDITION	ITYP	ELEV	TYPE OF INITIAL CONDITION
	RSRSPS RSVAC X	0.00 WORKING R AND D COEFFICIENT			
41 SV	STORAGE	0.0 10.5 21.2 31.9	42.8 53.8	65.0 76.2	87.6
42 SE	ELEVATION	486.00 486.50 487.00 487.50	488.00 488.50	489.00 489.50	490.00
43 SQ	DISCHARGE	0. 9. 26. 48.	74. 103.	136. 171.	209.

```

** ** ** ** ** *
*
*
* Pond2 *
*
*

```

OUTPUT CONTROL	VARIABLES	PRINT CONTROL
IPRNT	4	PRINT CONTROL
IPLOT	0	PLOT CONTROL
OSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	1	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORIGINATE PUNCHED OR SAVED
ISAV2	160	LAST ORIGINATE PUNCHED OR SAVED
TIMEIN	0.167	TIME INTERVAL IN HOURS
TTIMNT		

TIME	DATA FOR INPUT TIME SERIES	6	TIME INTERVAL IN MINUTES
JXNIN			
JXDATE		1JAN94	STARTING DATE
JXTIME		0	STARTING TIME

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Havana6.out
22 SAVE HYDROGRAPH ON THIS UNIT
1 FIRST ORIGINATE PUNCHED OR SAVED
160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

78 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION	ITYP	ELEV	TYPE OF INITIAL CONDITION
	NSRVC	0.00 WORKING R AND D COEFFICIENT			
	X				
79 SV	STORAGE	0.0 9.7 19.5 29.4 39.3 49.3 59.4 69.6 79.7			
80 SQ	DISCHARGE	11. 31. 58. 89. 124. 163. 205. 251. 300.			
81 SE	ELEVATION	486.00 486.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00			

*** **

*
* Pond3B * New Proposed ash pond
*

83 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

87 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

84 BA SUBBASIN CHARACTERISTICS
TAREA, 0.07 SUBBASIN AREA
85 BF BASE FLOW CHARACTERISTICS
STRTQ 11.90 INITIAL FLOW
QRCNS 0.00 BEGIN BASE FLOW RECESSON
RTIOR 1.00000 RECESSON CONSTANT

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*A-157
Coal Combustion Waste Impoundment
Dam Assessment Report*

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HYDROGRAPH ROUTING DATA

117 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES/	ITVP	ELEV	TYPE OF INITIAL CONDITION
	NSUTPS	492.00 INITIAL CONDITION			
	RSVRIC	0.00 WORKING R AND D COEFFICIENT			
	X				
118 SV	STORAGE	0.0 22.2 44.5 67.0	89.6 112.3 135.1 158.0	181.1	
119 SE	ELEVATION	492.00 492.50 493.00 493.50 494.00	494.00 494.50 495.00 495.50	496.00	
120 SQ	DISCHARGE	0. 11. 31. 58. 89.	124. 163. 205. 251.		

121 KK

Pond3

122 KO

OUTPUT CONTROL VARIABLES

IPRNT 4 PRINT CONTROL

IPLOT 0 PLOT CONTROL

ISCA 0 HYDROGRAPH PLOT SCALE

ISCH 1 PUNCH COMPUTED HYDROGRAPH

ISOUT 22 SAVE HYDROGRAPH ON THIS UNIT

ISAV1 160 FIRST ORIGINATE PUNCHED OR SAVED

ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED

TINT 0.167 TIME INTERVAL IN HOURS

126 IN

TIME DATA FOR INPUT TIME SERIES

JXMIN 6 TIME INTERVAL IN MINUTES

JXDATE 1JAN94 STARTING DATE

JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

123 BA

SUBBASIN CHARACTERISTICS

TAREA, 0.01 SUBBASIN AREA

124 BF

BASE FLOW CHARACTERISTICS

STRIQ 0.00 INITIAL FLOW

QRCN 0.00 BEGIN BASE FLOW RECESSON

RTOR 1.00000 RECESSON CONSTANT

PRECIPITATION DATA

125 PB

STORM 16.00 BASIN TOTAL PRECIPITATION

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Havana6.out

157 KK * Stplot * CNAME ABC

158 KO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
OSCAL 0 HYDROGRAPH PLOT SCALE
IPUNCH 0 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

	STORAGE ROUTING		1 NUMBER OF SUBREACHES/ 484.00 INITIAL CONDITION		ITYP		ELEV TYPE OF INITIAL CONDITION	
	RSPTS	RSVRIC	0.00 WORKING R	D COEFFICIENT				
159 RS								
160 SV	STORAGE	0.0	0.0	2.4	7.2	9.6	12.1	14.6
		22.4	25.0	27.6				
162 SE	ELEVATION	484.00	484.50	485.00	486.00	486.50	487.00	487.50
		489.00	489.50	490.00				
164 SQ	DISCHARGE	0.	7.	19.	35.	53.	72.	93.
		186.	210.	235.				
166 SE	ELEVATION	484.00	484.50	485.00	486.00	486.50	487.00	487.50
		489.00	489.50	490.00				

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.00	2.36	4.76	7.18	9.64	12.12	14.63	17.17	19.75
OUTFLOW	0.00	6.95	19.31	34.87	52.74	72.40	93.44	115.56	138.53	162.12
ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
STORAGE	22.35	24.98	27.64							
OUTFLOW	186.15	210.47	234.92							
ELEVATION	489.00	489.50	490.00							

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
Page 14

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Havana6.out										
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
					6-HOUR	24-HOUR	72-HOUR			
+										
+	HYDROGRAPH AT	Pond1	317.	12.00	44.	15.	14.	0.04		
+	ROUTED TO	Pipe1	23.	13.17	21.	11.	10.	0.04	486.92	13.17
+	HYDROGRAPH AT	Pond2	284.	12.00	39.	14.	12.	0.03		
+	ROUTED TO	Pipe2	35.	12.67	28.	16.	16.	0.03	486.57	12.67
+	HYDROGRAPH AT	Pond3B	650.	12.00	99.	43.	40.	0.07		
+	ROUTED TO	Pipe3	40.	14.17	39.	24.	22.	0.07	493.17	14.17
+	HYDROGRAPH AT	Pond3	74.	12.00	10.	4.	3.	0.01		
+	4 COMBINED AT	ABC	131.	12.00	95.	54.	50.	0.15		
+	ROUTED TO	Stplog	92.	15.33	86.	51.	47.	0.15	486.96	15.33

*** NORMAL END OF HEC-1 ***

**Effluent Pipe Analysis
Havana Power Station
East Ash Pond #3B**

**January 2, 2002
JHK**

The discharge from pond #3 is carried to the Illinois River by a 36-inch round reinforced concrete pipe. The pipe is fitted with Anderson Seals – a three-part rubber joint seal that allows the pipe to operate under pressure without leakage at the joints. Under normal conditions, the pipe does not flow full. At high flow conditions, water will back up in the stop log structure, pressurizing the effluent pipe.

The following conditions were analyzed using the FlowMaster program from Haestad.

1. 100-year, 24-hour storm, with all ponds discharging through the effluent pipe.
2. The ½-PMP storm, with all ponds discharging through the effluent pipe.

The results of the pressure pipe analysis for each of the two conditions is summarized below:

Condition	Required Flow (cfs)	Pressure at Pipe Inlet
1	42	neg. head- pipe not full
2	93	9.99 psi (~23' head)

Condition 2 would cause some water to overflow from the manholes located along the length of the 36" effluent pipe, due to the high pressure. This is acceptable because of the small likelihood of the ½-PMP storm and general flooding in the area from sources other than the pond.

However, as an additional precaution, the standpipe in pond 2 will be modified to restrict water flow into pond 3 once pond 3B is put into service. Pipe diameter will be reduced from 3' ϕ to 1.5' ϕ . Two additional HEC-1 runs were made to investigate effects on possible pressure and flow through first manhole:

1. Discharge from pond 2 reduced to reflect restricted flow. The HEC-1 analysis showed that flow at the outlet structure was reduced to 82 cfs, which translates into approximately a 13' head at the 1st manhole.
2. Same as above plus plant flow of 11.9 cfs stopped. This condition may require change in plant operating procedures if water is seen discharging through manhole. The HEC-1 analysis showed that flow at the outlet structure was reduced to 72 cfs, which translates into approximately a 6.9' head at the 1st manhole and 5.5' head at the 2nd manhole. The existing 1st manhole configuration shows that it is capable of containing up to 10.5' of head, which is greater than the 6.9' head calculated and 6.8' head at the 2nd manhole which is greater than the 5.5' calculated, therefore no overflow occurs once plant flow is stopped.

HA 100

HA 130

DRAFT

Eff. press. @ 93 cfs (0.5 PMP-16" storm)
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 93 cfs effluent flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	0.00 psi
Elevation at 1	464.00 ft
Elevation at 2	448.30 ft
Length	3,684.00 ft
C Coefficient	140.0
Diameter	36.00 in
Discharge	41,742.0 gal/min = 93 cfs

Results	
Pressure at 1	9.99 psi ~ 23.1' head
Headloss	38.75 ft
Energy Grade at 1	489.74 ft
Energy Grade at 2	450.99 ft
Hydraulic Grade at 1	487.05 ft
Hydraulic Grade at 2	448.30 ft
Flow Area	7.07 ft ²
Wetted Perimeter	9.42 ft
Velocity	13.16 ft/s
Velocity Head	2.69 ft
Friction Slope	0.010517 ft/ft

11/07/01
03:22:36 PM

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FlowMaster v5.15
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HA 131

DRAFT

Eff. pipe press. @42cfs(100 yr storm 7")
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 42 cfs effluent flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	0.00 psi
Elevation at 1	464.00 ft
Elevation at 2	448.30 ft
Length	3,684.00 ft
C Coefficient	140.0
Diameter	36.00 in
Discharge	18,850.0 gal/min = 42 cfs

Results		
Pressure at 1	-2.95	psi
Headloss	8.89	ft
Energy Grade at 1	457.74	ft
Energy Grade at 2	448.85	ft
Hydraulic Grade at 1	457.19	ft
Hydraulic Grade at 2	448.30	ft
Flow Area	7.07	ft ²
Wetted Perimeter	9.42	ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Friction Slope	0.002413	ft/ft

Pipe does not flow full

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HA 132

DRAFT

PROJECT: HAVANA EAST ASH POND 3B

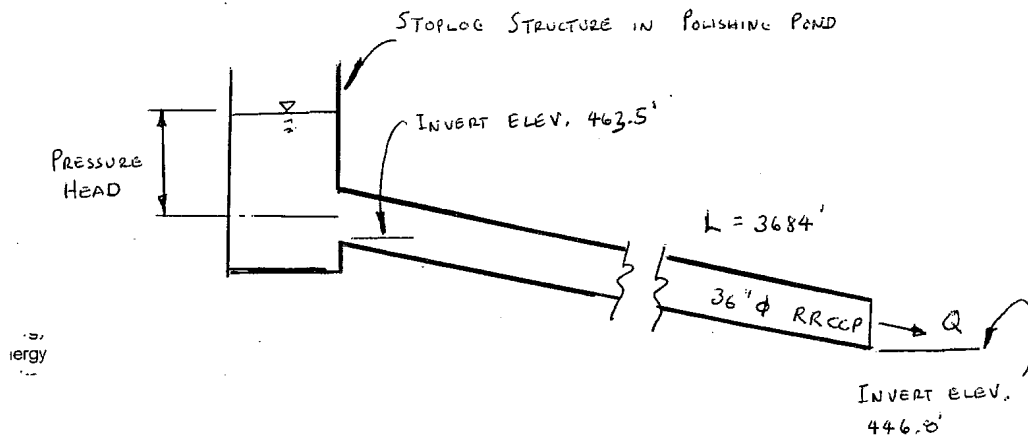
PROJECT NO.

SUBJECT: EFFLUENT PIPE ANALYSIS

DESIGNER: JHK

PAGE:

DATE:



SCHEMATIC OF EFFLUENT PIPE

HA 133

DRAFT

Submerged standpipe discharge
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pond 3B-Submerged standpipe flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.43 psi
Pressure at 2	2.60 psi
Elevation at 1	6.00 ft
Elevation at 2	0.00 ft
Length	150.00 ft
C Coefficient	135.0
Diameter	36.00 in

Results		
Discharge	31,378.0	gal/min
Headloss	0.99	ft
Energy Grade at 1	8.51	ft
Energy Grade at 2	7.52	ft
Hydraulic Grade at 1	6.99	ft
Hydraulic Grade at 2	6.00	ft
Flow Area	7.07	ft ²
Wetted Perimeter	9.42	ft
Velocity	9.89	ft/s
Velocity Head	1.52	ft
Friction Slope	0.006632	ft/ft

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FlowMaster v5.15
Page 1 of 1

HA 00-134

DRAFT

Eff. press. @ 82 cfs (0.5 PMP-16" storm)
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 92 cfs effluent flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	0.00 psi
Elevation at 1	465.00 ft
Elevation at 2	448.30 ft
Length	3,684.00 ft
C Coefficient	140.0
Diameter	36.00 in
Discharge	36,805.0 gal/min = 82 cfs

Results	
Pressure at 1	6.06 psi ~ 14' head @ OUTLET STRUCT.
Headloss	30.69 ft
Energy Grade at 1	481.08 ft
Energy Grade at 2	450.39 ft
Hydraulic Grade at 1	478.99 ft
Hydraulic Grade at 2	448.30 ft
Flow Area	7.07 ft ²
Wetted Perimeter	9.42 ft
Velocity	11.60 ft/s
Velocity Head	2.09 ft
Friction Slope	0.008330 ft/ft

@ NEW MANHOLE (700' FURTHER DOWNSTREAM)

$$\frac{14' (3684' - 173' - 700')}{3684'} = 10.3' @ \text{NEW MANHOLE}$$

HA 135

12/14/01
08:28:54 AM

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Page 1 of 1

DRAFT

Eff. press. @ 72 cfs (0.5 PMP-16" storm)
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 92 cfs effluent flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	0.00 psi
Elevation at 1	465.00 ft
Elevation at 2	448.30 ft
Length	3,684.00 ft
C Coefficient	140.0
Diameter	36.00 in
Discharge	32,316.0 gal/min = 72 cfs

Results	
Pressure at 1	3.22 psi
Headloss	24.12 ft
Energy Grade at 1	474.03 ft
Energy Grade at 2	449.91 ft
Hydraulic Grade at 1	472.42 ft
Hydraulic Grade at 2	448.30 ft
Flow Area	7.07 ft ²
Wetted Perimeter	9.42 ft
Velocity	10.19 ft/s
Velocity Head	1.61 ft
Friction Slope	0.006547 ft/ft

7.43' head @ OUTLET STRUCT.

$$\frac{7.43' (3684' - 273')}{3684'} = 6.88' @ 1^{ST} \text{ MANHOLE}$$

$$\phi \text{ of } 3' \text{ Pipe} = 463.5'$$

$$\text{GRADE ELEV. } 465'$$

$$\begin{array}{r} 465' \\ - 463.5' \\ \hline 1.5' \\ 3.0' \text{ STICK-UP ABOVE GRADE} \\ 3.0' \text{ EXTENSION PIECE} \\ \hline 6.5' \text{ ABOVE } \phi \text{ OF PIPE} > 7.43' \end{array}$$

@ NEW MANHOLE (700' FURTHER DOWNSTREAM)

$$\frac{7.43' (3684' - 273' - 700')}{3684'} = 5.47' @ \text{ NEW MANHOLE}$$

$$\begin{array}{r} \text{GRADE ELEV. } 466' \\ - 463.2' \phi \text{ OF PIPE} \\ + 3.0' \text{ STICK-UP} \\ \hline 5.8' > 5.47' \text{ OK} \end{array}$$

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08:29:31 AM

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FlowMaster v5.15
Page 1 of 1

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DRAFT

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* MAY 1991
* VERSION 4.0.1E
* RUN DATE TIME
*****
*****
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 551-1748
*****
```

Havana.out

Run #1

```

X X XXXXXX XXXX X
X X X X XXXX X
X X X X X X
XXXXXX XXXX X
X X X X XXXX X
X X X X XXXX X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1G, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKR- ON RH-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION.

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS-WRITE STAGE FREQUENCY,

DSS-READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID
3 ID
4 *DIAGRAM
5 IT 10 1JAN94 0 160
6 IO 4
7 KK Pond1
8 KO 0
9 BA 0.0358
10 PB 16 1JAN94 0
    *precip1
11 PC 0 0.001 0.002 0.0031 0.0041 0.0051 0.0062 0.0073 0.0083 0.0094
12 PC 0.0105 0.0116 0.0127 0.0138 0.015 0.0161 0.0173 0.0185 0.0196 0.0208
13 PC 0.022 0.0232 0.0244 0.0257 0.0269 0.0281 0.0294 0.0307 0.0319 0.0332
14 PC 0.0345 0.0358 0.0371 0.0384 0.0398 0.0411 0.0425 0.0438 0.0452 0.0466
15 PC 0.048 0.0494 0.0508 0.0523 0.0538 0.0553 0.0568 0.0583 0.0598 0.0614
16 PC 0.063 0.0646 0.0662 0.0679 0.0696 0.0712 0.073 0.0747 0.0764 0.0782

```

Page 1

17	PC	0.08	0.0818	0.0836	0.0855	Havana.out	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.105		0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.1233	0.1246	0.127		0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566		0.163	0.1663	0.1697	0.1733	0.1771	0.1808
21	PC	0.181	0.1851	0.1895	0.1941		0.1989	0.204	0.2094	0.2152	0.2214	0.228
22	PC	0.235	0.2427	0.2513	0.2609		0.2715	0.283	0.3068	0.3544	0.4308	0.5679
23	PC	0.663	0.682	0.6986	0.713		0.7252	0.735	0.7434	0.7514	0.7588	0.7656
24	PC	0.772	0.778	0.7836	0.789		0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8277	0.8373	0.8308		0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622		0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868		0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078		0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263		0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423		0.9438	0.9452	0.9466	0.948	0.9494	0.9507
31	PC	0.952	0.9533	0.9546	0.9559		0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685		0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806		0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
34	PC	0.9887	0.9899	0.991	0.9922		0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	PC	1	1	1	1		1	1	1	1	1	1
36	LS	0	100	100								
37	UD	0.15										
38	KK	Pipel	CNAME	C								
39	RO	0	0	0	0							
40	RS	1	ELEV	486	C							
41	Sv	Pondlvcl	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62	
42	SE	486	486.5	487	487.5	488	488.5	489	489.5	490		
43	SQ	0	9.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	
44	KK	Pond2										
45	NO	0	0	0	1	22						
46	BA	0.032										
47	EB	16										
48	IN	6	1JAN94	0								
49	PC	0.001	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094	
50	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208	
51	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332	
52	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466	
53	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614	
54	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782	
55	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097	
56	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178	
57	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439	
58	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771	
59	PC	0.181	0.1851	0.1893	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228	
60	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679	
61	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656	
62	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162	

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DRAFT

63	PC	0.82	0.8237	0.8273	0.8308	0.8376	0.8409	0.8442	0.8474	0.8505
64	PC	0.8535	0.8565	0.8594	0.8622	0.8676	0.8702	0.8728	0.8753	0.8777
65	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8977
66	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9135	0.9155	0.9174
67	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346
68	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9465	0.948	0.9494
69	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622
70	PC	0.967	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746
71	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864
72	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9955	0.9967	0.9978
73	PC	1	1	1	1	1	1	1	1	1
74	LS	0	100	100	100	100	100	100	100	100
75	UD	0.15								
76	KK	Pipe2	CNAME	B						
77	RS	0	0	0	0	0	22			
78	RS	1	ELEV	486	0					
79	SV	pend2vol	0	9.73	19.54	29.4	39.34	49.34	59.41	69.55
80	SO	pend2out	0	15.69	28.9	28.9	28.9	28.9	28.9	28.9
81	SE	pend2elev	486.5	487	487.5	488	488.5	489	489.5	490
82	KK	Pond3a	New proposed ash pond							
83	KO	0	0	0	1	22				
84	BA	0.072								
85	BF	11.9	0	0						
86	BS	16								
87	IN	6	1JAN94	0						
88	PC	Precip	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073
89	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196
90	PC	0.022	0.0232	0.024	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319
HEC-1 INPUT										
LINE	ID	1	2	3	4	5	6	7	8	9
91	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452
92	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598
93	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764
94	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095
95	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156
96	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408
97	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733
98	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214
99	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308
100	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588
101	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122
102	PC	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
103	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753
104	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976
105	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9135	0.9155	0.9174
106	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346
107	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9465	0.948	0.9494
108	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622

PAGE 3

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DRAFT

LINE	ID	1	2	3	4	5	6	7	8	9	10
109	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.977	0.9782	0.9794	0.9805	0.9816	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9887	0.9899	0.991	0.9921	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
112	PC	1	1	1	1	1	1	1	1	1	1
113	LS	0	100	100	100	100	100	100	100	100	100
114	UD	0.15									
115	KK	Pip#3	CNAME	D							
116	KO	0	0	0	0	0	22				
117	RS	1	ELEV	492	0						
118	SV	0	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.12	
119	SE	492	492.5	493	493.5	494	494.5	495	495.5	496	
120	SQ	0	11.1	31.38	57.66	57.66	57.66	57.66	57.66	57.66	57.66
121	KK	Pond3									
122	KO	0	0	0	1	22					
123	BA	0.0003									
124	BF	0	0	0							
125	PB	16									
126	IN	6	1JAN94	0							
127	PC	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
128	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
129	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
130	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
131	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
132	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
133	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
134	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
135	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
136	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
137	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
138	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
139	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588	0.7656

PAGE 4

HSC-1 INPUT

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DRAFT

154	KK	ABC	CNAME	Stplog	Havana.out
155	KO	0	0	0	22
156	HC	4	0	0	
157	KK	Stplog	CNAME	ABC	
158	KO	0	0	0	22
159	RS	1	ELEV	484	0
160	* pond3vol	0	0	2.36	7.18
161	SV	22.35	24.98	27.64	9.48
162	* pondelv	484	484.5	485	12.12
163	SE	489	489.5	490	14.63
164	* pond3out	0	6.95	19.31	17.17
165	SQ	210.47	234.92	293.6	19.75
166	* pondelv	484	484.5	485	
167	SE	489	489.5	490	488
168	ZZ				488.5

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO. (V) ROUTING (--->) DIVERSION OR PUMP FLOW (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

6 Pond1 V
38 Pipel V
44 .
76 .
82 .
115 .
121 .
154 ABC.....
157 Stplog V

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *

DRAFT

Havana.out

* * * * *

* HYDROLOGIC ENGINEERING CENTER *

* 609 SECOND STREET *

* DAVIS, CALIFORNIA 95616 *

* (916) 551-1749 *

* * * * *

Havana.out

* * * * *

* MAY 1991 *

* VERSION 4.0.1E *

* * * * *

* RUN DATE TIME *

* * * * *

5 IO OUTPUT CONTROL VARIABLES

IPRNT 4 PRINT CONTROL

IPLOT 0 PLOT CONTROL

QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN 10 MINUTES IN COMPUTATION INTERVAL

IDATE 1JAN94 STARTING DATE

ITIME 0000 STARTING TIME

NQ 160 NUMBER OF HYDROGRAPH ORIGINATES

NDDATE 2JAN94 ENDING DATE

NDTIME 0230 ENDING TIME

ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS

TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS

DRAINAGE AREA SQUARE MILES

PRECIPITATION DEPTH INCHES

LENGTH, ELEVATION FEET

FLOW CUBIC FEET PER SECOND

STORAGE VOLUME ACRE-Feet

SURFACE AREA ACRES

TEMPERATURE DEGREES FAHRENHEIT

6 KK

* * * * *

* Pond1 *

* * * * *

7 KO OUTPUT CONTROL VARIABLES

IPRNT 4 PRINT CONTROL

IPLOT 0 PLOT CONTROL

QSCAL 0. HYDROGRAPH PLOT SCALE

IPNCH 1 PUNCH COMPUTED HYDROGRAPH

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H17 143

A-175

HA ~~002~~
144

39 NO	OUTPUT CONTROL VARIABLES
IPRNT	4 PRINT CONTROL
IPLOT	0 PLOT CONTROL
OSCAL	0 HYDROGRAPH PLOT SCALE
IPNCH	0 PUNCH COMPUTED HYDROGRAPH
ISUIT	22 SAVE HYDROGRAPH ON THIS UNIT
ISAVE	0 PUNCH COMPUTED HYDROGRAPH
ISAV2	160 LAST ORIGINATE PUNCHED OR SAVED
TIMEIN	0.167 TIME INTERVAL IN HOURS
TIMEIN	

HYDROGRAPH ROUTING DATA.

40 RS	STORAGE ROUTING NSRPS RSVAC X	1 NUMBER OF SUBRECHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	ITYP	ELEV TYPE OF INITIAL CONDITION
41 SV	STORAGE	0.0 10.5 21.2 31.9	42.8 53.8	65.0 76.2 87.6
42 SE	ELEVATION	486.00 486.50 487.00 487.50	488.00 488.50 489.00 489.50	489.00 490.00
43 SQ	DISCHARGE	0. 9. 26. 26.	26. 26.	26. 26.

[illegible]

```

** ** ** ** **
**
44 KK
**
** Pond2 **
**
** ** ** **

```

45 NO	OUTPUT	CONTROL	VARIABLES
	IPRNT		4
	IPLOT		0
	QSCAL		0.
	IPNCH		1
	IOUT		22
	ISAV1		1
	ISAV2		160
	ITIME		0.167
	TIME		INTERVAL IN HOURS
		PRINT CONTROL	
		PLOT CONTROL	
		HYDROGRAPH PLOT SCALE	
		PUNCH COMPUTED HYDROGRAPH	
		SAVE HYDROGRAPH ON THIS UNIT	
		FIRST ORIGINATE PUNCHED OR SAVED	
		LAST ORIGINATE PUNCHED OR SAVED	
		TIME INTERVAL IN HOURS	

```

48 IN      TIME DATA FOR INPUT TIME SERIES
          JXMIN      6  TIME INTERVAL IN MINUTES
          JXDATE     1JAN94  STARTING DATE
          JXTIME     0  STARTING TIME

```

HA 145

A-177

HA-008
146

HYDROGRAPH ROUTING DATA

[illegible]

New proposed ash pond

LAST ORDINARY PUNCHED TIME INTERVAL. TN HOURS

STARTING TIME

SUBBASIN RUNOFF DATA

0.07 SE

Page 10

HA 147

UNIT HYDROGRAPH	
7	END-OF-PERIOD ORDINATES
108	33
122	10
	3
	1
	0

[illegible]

116 KO	OUTPUT CONTROL VARIABLES	
	IPRNT	4 PRINT CONTROL
	IPLOT	0 PLOT CONTROL
	QSCAL	0. HYDROGRAPH PLOT SCALE
	IPNCH	0 PUNCH COMPUTED HYDROGRAPH
	IOUT	22 SAVE HYDROGRAPH ON THIS UNIT
	ISAV1	1 FIRST ORIGINATE PUNCHED OR SAVED
	ISAV2	160 LAST ORIGINATE PUNCHED OR SAVED
	TIMEINT	0.167 TIME INTERVAL IN HOURS

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Havana.out

117 RS HYDROGRAPH ROUTING DATA

STORAGE ROUTING

NSRPS 1 NUMBER OF SUBREACHES/

RSVRIC 492.00 INITIAL CONDITION

X 0.00 WORKING R AND D COEFFICIENT

STORAGE 0.0 22.2 44.5 67.0 89.6 112.3 135.1 158.0 181.1

ELEVATION 492.00 492.50 493.00 493.50 494.00 494.50 495.00 495.50 496.00

DISCHARGE 0. 11. 31. 58. 58. 58. 58. 58. 58.

118 SV

119 SE

120 SQ

121 KK *****

* Pond3 *

* *****

122 KO OUTPUT CONTROL VARIABLES

IPRNT 4 PRINT CONTROL

IPLOT 0 PLOT CONTROL

OSCAL 0. HYDROGRAPH PLOT SCALE

IPNCH 1 PUNCH COMPUTED HYDROGRAPH

IOUT 22 SAVE HYDROGRAPH ON THIS UNIT

ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED

ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED

TIMNT 0.167 TIME INTERVAL IN HOURS

126 IN TIME DATA FOR INPUT TIME SERIES

JAMIN 6 TIME INTERVAL IN MINUTES

JDATE 1JAN94 STARTING DATE

JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

123 BA SUBBASIN CHARACTERISTICS

TAREA, 0.01 SUBBASIN AREA

124 BF BASE FLOW CHARACTERISTICS

STRFQ 0.00 INITIAL FLOW

QRCSN 0.00 BEGIN BASE FLOW RECESSON

RTIOR 1.00000 RECESSON CONSTANT

PRECIPITATION DATA

STORM 16.00 BASIN TOTAL PRECIPITATION

125 PB

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NA 000
148

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*** **

157 KK * * Stplot * * CNAME ABC

158 KO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCALE 0 HYDROGRAPH PLOT SCALE
IPUNCH 0 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

	STORAGE ROUTING	NSTPS		1 NUMBER OF SUBREACHES/		ITYP		ELEV TYPE OF INITIAL CONDITION			
		RSVIC	X	484.00 INITIAL CONDITION	0.00 WORKING R AND D COEFFICIENT						
160 SV	STORAGE	0.0	0.0	2.4	4.8	7.2	9.5	12.1	14.6	17.2	19.7
		22.4	25.0	27.6							
162 SE	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
		489.00	489.50	490.00							
164 SQ	DISCHARGE	0.	7.	19.	35.	53.	72.	93.	116.	139.	162.
		210.	235.	294.							
166 SE	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
		489.00	489.50	490.00							

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.00	2.36	4.76	7.18	9.48	12.12	14.63	17.17	19.75
OUTFLOW	0.00	6.95	19.31	34.87	52.74	72.40	93.44	115.56	138.53	162.12
ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
STORAGE	22.35	24.98	27.64							
OUTFLOW	210.47	234.92	293.60							
ELEVATION	489.00	489.50	490.00							

□

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
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	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	Havana.out			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
					AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	72-HOUR			
+										
+	HYDROGRAPH AT	Pond1	317.	12.00	44.	15.	14.	0.04		
+	ROUTED TO	Pipe1	23.	13.17	21.	11.	10.	0.04	486.92	13.17
+										
+	HYDROGRAPH AT	Pond2	284.	12.00	39.	14.	12.	0.03		
+	ROUTED TO	Pipe2	21.	13.17	19.	12.	11.	0.03	486.71	13.17
+										
+	HYDROGRAPH AT	Pond3B	650.	12.00	99.	43.	40.	0.07		
+	ROUTED TO	Pipe3	40.	14.17	39.	24.	22.	0.07	493.17	14.17
+										
+	HYDROGRAPH AT	Pond3	74.	12.00	10.	4.	3.	0.01		
+	4 COMBINED AT	ABC	121.	12.00	86.	49.	45.	0.15		
+	ROUTED TO	Stdlog	82.	15.67	78.	46.	42.	0.15	486.72	15.67
+										

*** NORMAL END OF HEC-1 ***

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25#2

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[illegible]

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GB, HEC1DB, AND HEC1KW. THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTION: DABREAK OUTFLOW SUBSEQUENCE, SINGLE EVENT DAMAGE CALCULATION, DSS.WRITE STAGE FREQUENCY, DSS.READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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HEC-1 INPUT

LINE	10	11	12	13	14	15	16	17	18	19	20
1	ID										
2	ID										
3	ID										
4	*DIAGRAM										
5	IT	10	1UAN94	0	160						
6	IO	4									
7	KK	Pendl									
8	BA	0	0	0	1	22					
9	BA	0.0358									
10	PB	16									
11	IN	16	1UAN94	0							
12	PRECIP	10	0.001	0.002	0.031	0.041	0.0051	0.0062	0.0073	0.0083	0.0094
13	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
14	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
15	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
16	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
17	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782

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17	PC	0.08	0.0018	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
18	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
19	PC	0.12	0.123	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
20	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
21	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.203	0.2084	0.2132	0.2184	0.228
22	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.2968	0.314	0.3308	0.3579
23	PC	0.663	0.682	0.6986	0.713	0.7252	0.739	0.754	0.7688	0.7856	0.8036
24	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162
25	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
26	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
27	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976	0.8997
28	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
29	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
30	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
31	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
32	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
33	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9876
34	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
35	FC	1	1	1	1	1	1	1	1	1	1
36	LS	0	100	100	100	100	100	100	100	100	100
37	UD	0.15									
38	KK	Pipel	CNAME	C							
39	NO	0	0	0	0	22					
40	RS	1	ELEV	486	0						
41	SV	Pondlv	0	10.53	21.17	31.94	42.84	53.85	64.98	76.24	87.62
42	SE	Pondlev	486	486.5	487	487.5	488	488.5	489	489.5	490
43	SQ	Pondlv	0	9.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
44	KK	Pond2	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083
45	RO	0	0.016	0.017	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
46	BA	0.032	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.032
47	EB	16	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452
48	IN	16	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598
49	* precip	0	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764
50	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
51	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
52	PC	0.12	0.123	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
53	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733	0.1771
54	PC	0.181	0.1851	0.1895	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
55	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.2968	0.314	0.3308	0.3579
56	PC	0.663	0.682	0.6986	0.713	0.7252	0.739	0.754	0.7688	0.7856	0.8036
57	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122	0.8162

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63	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
64	PC	0.8435	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753	0.8777
65	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8953	0.8976	0.8997
66	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
67	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
68	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
69	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635
70	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746	0.9758
71	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864	0.9875
72	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978	0.9989
73	PC	1	1	1	1	1	1	1	1	1	1
74	LS	0	100	100							
75	UD	0.15									
76	KK	Pipe2	CNAME	B	0	0	22				
77	RO	0	0	0	0	0					
78	RS	1	ELEV	486	0						
79	* pond2vol	0	9.73	19.54	29.4	39.34	49.34	59.41	69.55	79.75	
80	* pond2out	0									
81	* pond2elev	0	5.55	15.69	28.9	28.9	28.9	28.9	28.9	28.9	
82	SE	486	486.5	487	487.5	488	488.5	489	489.5	490	
83	KK	Pond3B	New proposed ash pond								
84	RO	0	0	0	1	22					
85	BA	0.072									
86	BF	0	0	0							
87	IN	16	1JAN94	0							
88	* precip1	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083	0.0094
89	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196	0.0208
90	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319	0.0332
91	ID	.....1	.....2	.....3	.....4	.....5	.....6	.....7	.....8	.....9	.....10
92	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452	0.0466
93	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598	0.0614
94	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.073	0.0747	0.0764	0.0782
95	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095	0.097
96	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156	0.1178
97	PC	0.12	0.1233	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408	0.1439
98	PC	0.147	0.1502	0.1534	0.1566	0.163	0.1663	0.1697	0.1733	0.1771	0.181
99	PC	0.181	0.1841	0.1885	0.1941	0.1989	0.204	0.2094	0.2152	0.2214	0.228
100	PC	0.235	0.247	0.2612	0.269	0.2715	0.283	0.3068	0.3544	0.4308	0.5679
101	PC	0.653	0.682	0.7086	0.733	0.752	0.775	0.7934	0.7514	0.7588	0.7656
102	PC	0.772	0.779	0.786	0.793	0.799	0.8036	0.808	0.8122	0.8166	0.8214
103	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474	0.8505
104	PC	0.8535	0.8565	0.8594	0.8622	0.865	0.8676	0.8702	0.8728	0.8753	0.8777
105	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8953	0.8976	0.8997
106	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174	0.9192
107	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346	0.9362
108	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494	0.9507
	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622	0.9635

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109	PC	0.9647	0.966	0.9672	0.9685	0.9709	0.9722	0.9734	0.9746	0.9758
110	PC	0.9777	0.9782	0.9794	0.9806	0.9829	0.9841	0.9853	0.9864	0.9876
111	PC	0.9887	0.9899	0.9911	0.9922	0.9934	0.9946	0.9958	0.9969	0.9989
112	PC	1	1	1	1	1	1	1	1	1
113	LS	0	100	100	100	100	100	100	100	100
114	UD	0.15								
115	KK	Pipe3	CNAME	D	0	22				
116	KO	0	0	0	0					
117	RS	1	ELEV	492	0					
118	SV	0	22.2	44.53	66.98	89.56	112.26	135.09	158.04	181.12
119	* pond3Belev									
120	SE	492	492.5	493	493.5	494	494.5	495	495.5	496
121	* pond3Bout									
122	SQ	0	11.1	31.38	57.66	57.66	57.66	57.66	57.66	57.66
123	KK	Pond3								
124	KO	0	0	0	1	22				
125	BA	0.0083								
126	BF	0	0	0						
127	PB	16								
128	IN	6	1JAN94	0						
129	* precip1									
130	PC	0	0.001	0.002	0.0031	0.0041	0.0051	0.0062	0.0073	0.0083
131	PC	0.0105	0.0116	0.0127	0.0138	0.015	0.0161	0.0173	0.0185	0.0196
132	PC	0.022	0.0232	0.0244	0.0257	0.0269	0.0281	0.0294	0.0307	0.0319
133	PC	0.0345	0.0358	0.0371	0.0384	0.0398	0.0411	0.0425	0.0438	0.0452
134	PC	0.048	0.0494	0.0508	0.0523	0.0538	0.0553	0.0568	0.0583	0.0598
135	PC	0.063	0.0646	0.0662	0.0679	0.0696	0.0712	0.0729	0.0746	0.0764
136	PC	0.08	0.0818	0.0836	0.0855	0.0874	0.0892	0.0912	0.0931	0.095
137	PC	0.099	0.101	0.103	0.1051	0.1072	0.1093	0.1114	0.1135	0.1156
138	PC	0.12	0.1223	0.1246	0.1271	0.1296	0.1323	0.135	0.1379	0.1408
139	PC	0.147	0.1502	0.1534	0.1566	0.1598	0.163	0.1663	0.1697	0.1733
140	PC	0.181	0.1831	0.1859	0.1941	0.1989	0.204	0.2094	0.2152	0.2214
141	PC	0.235	0.2427	0.2513	0.2609	0.2715	0.283	0.3068	0.354	0.4308
142	PC	0.663	0.682	0.6986	0.713	0.7252	0.735	0.7434	0.7514	0.7588
143	PC	0.772	0.778	0.7836	0.789	0.7942	0.799	0.8036	0.808	0.8122
144	PC	0.82	0.8237	0.8273	0.8308	0.8342	0.8376	0.8409	0.8442	0.8474
145	PC	0.8535	0.8565	0.8594	0.8622	0.8649	0.8676	0.8702	0.8728	0.8753
146	PC	0.88	0.8823	0.8846	0.8868	0.889	0.8912	0.8934	0.8955	0.8976
147	PC	0.9018	0.9038	0.9058	0.9078	0.9098	0.9117	0.9136	0.9155	0.9174
148	PC	0.921	0.9228	0.9246	0.9263	0.928	0.9297	0.9314	0.933	0.9346
149	PC	0.9377	0.9393	0.9408	0.9423	0.9438	0.9452	0.9466	0.948	0.9494
150	PC	0.952	0.9533	0.9546	0.9559	0.9572	0.9584	0.9597	0.961	0.9622
151	PC	0.9647	0.966	0.9672	0.9685	0.9697	0.9709	0.9722	0.9734	0.9746
152	PC	0.977	0.9782	0.9794	0.9806	0.9818	0.9829	0.9841	0.9853	0.9864
153	PC	0.9887	0.9899	0.991	0.9922	0.9933	0.9944	0.9956	0.9967	0.9978
154	PC	1	1	1	1	1	1	1	1	1
155	LS	0	100	100	100	100	100	100	100	100
156	UD	0.15								

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HA 155

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*
* U. S. ARMY CORPS OF ENGINEERS *

DRAFT

Havana.out
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 551-1748 *

* MAY 1991 *
* VERSION 4.0.1E *
* RUN DATE TIME *

5 IO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 10 MINUTES IN COMPUTATION INTERVAL
IDATE 1JAN94 STARTING DATE
ITIME 0000 STARTING TIME
NO. 160 NUMBER OF HYDROGRAPH ORDINATES
NDATE 2JAN94 ENDING DATE
NDTIME 0230 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 26.50 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW, CUMULATIVE CUBIC FEET PER SECOND
STORAGE VOLUME ACRES-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

6 RK Pond1 *

7 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
INCH 1 PUNCH COMPUTED HYDROGRAPH
Page 6

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38 KK * * * * *
* * * * *
* * * * *
* * * * *

39 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 0 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

40 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES/
RSVRIC 486.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

41 SV STORAGE 0.0 10.5 21.2 31.9 42.8 53.8 65.0 76.2 87.6

42 SE ELEVATION 486.00 486.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00

43 SQ DISCHARGE 0. 9. 26. 26. 26. 26. 26. 26. 26.

44 KK * * * * *
* * * * *
* * * * *
* * * * *

45 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IPNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

48 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

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HA ~~25~~
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Coal Combustion Waste Impoundment
Dam Assessment Report

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22 SAVE HYDROGRAPH ON THIS UNIT
1 FIRST ORDINATE PUNCHED OR SAVED
ISAV1
160 LAST ORDINATE PUNCHED OR SAVED
ISAV2
0.167 TIME INTERVAL IN HOURS
TIMINT

HYDROGRAPH ROUTING DATA

	STORAGE ROUTING				ITYP	ELEV	TYPE OF INITIAL CONDITION
78 RS	NSPTS	486.00	INITIAL CONDITION				
	RSVRIC	0.00	WORKING R AND D COEFFICIENT				
	X						
79 SV	STORAGE	0.0	9.7	19.5	29.4	39.3	49.3
80 SQ	DISCHARGE	6.	16.	29.	29.	29.	29.
81 SE	ELEVATION	486.00	486.50	487.00	487.50	488.00	488.50
							489.00
							489.50
							490.00

82 KK * Pond3b * New proposed ash pond

83 KO OUTPUT CONTROL VARIABLES
IPRINT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
OSCAL 0. HYDROGRAPH PLOT SCALE
ZFNCH 1 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2 160 LAST ORDINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

87 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 6 TIME INTERVAL IN MINUTES
JXDATE 1JAN94 STARTING DATE
JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

84 BA SUBBASIN CHARACTERISTICS
TAREA, 0.07 SUBBASIN AREA

85 BF BASE FLOW CHARACTERISTICS
SIRTC 0.00 INITIAL FLOW
QRCN 0.00 BEGIN BASE FLOW RECESSON
RTIOR 1.00000 RECESSON CONSTANT

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HYDROGRAPH ROUTING DATA

117 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES/	ITYP	ELEV	TYPE OF INITIAL CONDITION
	NSVCS	492.00 INITIAL CONDITION			
	RSVRC	0.00 WORKING R AND D COEFFICIENT			
	X				
118 SV	STORAGE	0.0 22.2 44.5 67.0 89.6 112.3 135.1 158.0 181.1			
119 SE	ELEVATION	492.00 492.50 493.00 493.50 494.00 494.50 495.00 495.50 496.00			
120 SQ	DISCHARGE	0. 11. 31. 58. 58. 58. 58. 58. 58.			

*** **

121 KK * Pond3 *

122 KO OUTPUT CONTROL VARIABLES

4 PRINT CONTROL

0 PLOT CONTROL

0 HYDROGRAPH PLOT SCALE

1 PUNCH COMPUTED HYDROGRAPH

22 SAVE HYDROGRAPH ON THIS UNIT

ISAV1 FIRST ORIGINATE PUNCHED OR SAVED

ISAV2 LAST ORIGINATE PUNCHED OR SAVED

TIMINT 0.167 TIME INTERVAL IN HOURS

126 IN TIME DATA FOR INPUT TIME SERIES

6 TIME INTERVAL IN MINUTES

JXDATE 1JUN94 STARTING DATE

JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

123 BA SUBBASIN CHARACTERISTICS

TAREA, 0.01 SUBBASIN AREA

124 BF BASE FLOW CHARACTERISTICS

SHRQ 0.00 INITIAL FLOW

QRCN 0.00 BEGIN BASE FLOW RECESSON

RRIOR 1.00000 RECESSON CONSTANT

PRECIPITATION DATA

STORM 16.00 BASIN TOTAL PRECIPITATION

125 PB

HA 27
164

<i>Havana Power Plant</i>	<i>A-196</i>
<i>Dynegy Midwest Generation, Inc.</i>	<i>Coal Combustion Waste Impoundment</i>
<i>Havana, IL</i>	<i>Dam Assessment Report</i>

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*** ** ** ** **

*
* Stplot *
*

157 KK CNAME ABC

158 KO OUTPUT CONTROL VARIABLES

IPRNT 4 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCALE 0. HYDROGRAPH PLOT SCALE
IPNCH 0 PUNCH COMPUTED HYDROGRAPH
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1 1 FIRST ORIGINATE PUNCHED OR SAVED
ISAV2 160 LAST ORIGINATE PUNCHED OR SAVED
TIMINT 0.167 TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

159 RS STORAGE ROUTING

NSRPS
RSRVC 484.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

160 SV STORAGE

0.0 0.0 2.4 4.8
22.4 25.0 27.6

162 SE ELEVATION

484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50

164 SQ DISCHARGE

0. 7. 19. 35. 53. 72. 93. 116. 139. 162.

166 SE ELEVATION

484.00 484.50 485.00 485.50 486.00 486.50 487.00 487.50 488.00 488.50

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	2.36	4.76	7.18	9.48	12.12	14.63	17.17	19.75
OUTFLOW	0.00	6.93	19.31	34.87	52.74	72.40	93.44	115.56	138.53
ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00
STORAGE	22.35	24.98	27.64						
OUTFLOW	210.47	234.92	263.60						
ELEVATION	489.00	489.50	490.00						

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
Page 14

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Havana.out									
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD	72-HOUR	24-HOUR	6-HOUR	
+	HYDROGRAPH AT	Pond1	317.	12.00	44.	15.	14.	0.04	
+	ROUTED TO	Pipe1	23.	13.17	21.	11.	10.	0.04	486.92
+	HYDROGRAPH AT	Pond2	284.	12.00	39.	14.	12.	0.03	
+	ROUTED TO	Pipe2	21.	13.17	19.	12.	11.	0.03	486.71
+	HYDROGRAPH AT	Pond3B	638.	12.00	88.	31.	28.	0.07	
+	ROUTED TO	Pipe3	30.	14.00	29.	16.	15.	0.07	492.96
+	HYDROGRAPH AT	Pond3	74.	12.00	10.	4.	3.	0.01	
+	4 COMBINED AT	ABC	112.	12.00	76.	42.	39.	0.15	
+	ROUTED TO	Stplog	72.	15.50	68.	39.	36.	0.15	486.48
+									15.50

*** NORMAL END OF HEC-1 ***

HA 166

DRAFT

Energy Dissipation
Havana Power Station
East Ash Pond #3B

July 24, 2001
JHK

Energy dissipation of the pond outflow is provided by large riprap at the downstream end of the existing effluent pipe. Since its installation, this riprap has provided good slope protection at the pipe discharge. During a period of lowering the pond by pulling stoplogs, the effluent pipe carried much higher flows than normal, and during this time the riprap held up and provided slope protection.

Based on this historical information, it is a reasonable assumption that the riprap will continue to hold up and provide good energy dissipation and slope protection. No changes are proposed as part of construction of pond #3B.

NA 8/9
167

DRAFT

De-watering Method and Calculations
Havana Power Station
East Ash Pond #3B

November 5, 2001
JHK

In the event that the pond system would need to be de-watered, the stoplog structure in the polishing pond (pond #3) will be used. It will be possible to de-water half of the total reservoir in seven days using the stoplog outlet structure as outlined below.

The partition between pond 3B and pond 3 will be breached with Illinois Power earthmoving equipment stationed at the plant or by a contractor's equipment. This will equalize the level in these ponds at a level close to elevation 492.0 feet, since the elevation of pond 3B is at 492' and of pond 3 at elevation 486' with the bulk of the volume coming from pond 3B. The total volume of water will be 1321.1 acre-feet at the start of de-watering. To reduce the volume to 660 acre-feet, the water level will need to be reduced to elevation 476.75 feet. To lower the pond 15.25 feet, 23 of the eight-inch tall stoplogs will be to be removed. Over a seven-day period, this works out to removing one stoplog approximately every 7 hours. The breach between ponds 3 and 3B will be deepened as necessary while de-watering these ponds.

The average flow during de-watering will be 47.5 cfs. The effluent pipe would not flow full at this rate. The flow measurement device downstream of the stoplog structure will be monitored during de-watering to ensure stoplogs are being removed at a sufficient rate to de-water half the pond volume in 7 days.

Pond 1 and 2 will be full of ash by the time pond 3B is finished. Therefore, ponds 1 and 2 are not considered in the de-watering plan.

The following pages contain the calculations for the de-watering plan.

HA 70
168

DRAFT

**De-watering Method and Calculations
Havana Power Station
East Ash Pond #3B**

**November 5, 2001
JHK**

Pond 3- Pool volume at elev. 486.0' = 138,000 cu. Yd.
= 85.54 acre-ft.

Area at elev. 486' = 4.89 acres

Area at elev. 462' = 94,471 sq. ft.
= 2.17 acres

$\Delta = (4.89 - 2.17)/(486' - 462') = 0.113 \text{ acres/ft.}$

$V_y = 85.54 \text{ acre-ft} - \frac{1}{2}(4.89 \times 2 - 0.113[486 - y])(486 - y)$

Pond 3B- Pool volume at elev. 492.0' = 1,993,412 cu. Yd.
= 1235.6 acre-ft.

Area at elev. 492' = 1,928,962.6 sq. ft. = 44.28 acres

Area at elev. 460' = 1,243,043 sq. ft. = 28.536 acres

$\Delta = (44.28 - 28.536)/(492' - 460') = 0.492 \text{ acres/ft.}$

$V_y = 1235.6 \text{ acre-ft} - \frac{1}{2}(44.28 \times 2 - 0.492[492 - y])(492 - y)$

Total volume of pond system at elev. 486' = 1235.6 + 85.54
= 1321.1 acre-ft.

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Pond 3 Volume = 85.54 acre-ft $-(0.5)(4.89 \times 2 - 0.113[486-y])(486-y)$

Pond 3B Volume = 1235.6 acre-ft $-(0.5)(44.28 \times 2 - 0.492[492-y])(492-y)$

Havana De-watering volume calculations for Ponds 3 & 3B

Elev.(ft)	Pond 3 volume (acre-ft)	Pond 3B volume (acre-ft)	Total volume (acre-ft)
492.00	85.54	1235.60	1321.14
491.50	85.54	1213.52	1299.06
491.00	85.54	1191.57	1277.11
490.50	85.54	1169.73	1255.27
490.00	85.54	1148.02	1233.56
489.50	85.54	1126.44	1211.98
489.00	85.54	1104.97	1190.51
488.50	85.54	1083.63	1169.17
488.00	85.54	1062.42	1147.96
487.50	85.54	1041.32	1126.86
487.00	85.54	1020.35	1105.89
486.50	85.54	999.50	1085.04
486.00	85.54	978.78	1064.32
485.50	83.11	958.17	1041.28
485.00	80.71	937.69	1018.40
484.50	78.33	917.34	995.67
484.00	75.99	897.10	973.09
483.50	73.67	876.99	950.66
483.00	71.38	857.01	928.38
482.50	69.12	837.14	906.26
482.00	66.88	817.40	884.28
481.50	64.68	797.78	862.46
481.00	62.50	778.29	840.79
480.50	60.35	758.91	819.27
480.00	58.23	739.66	797.90
479.50	56.14	720.54	776.68
479.00	54.08	701.53	755.61
478.50	52.04	682.65	734.70
478.00	50.04	663.90	713.93
477.50	48.06	645.26	693.32
477.00	46.11	626.75	672.86
476.50	44.18	608.36	652.55
476.00	42.29	590.10	632.39
475.50	40.42	571.95	612.38
475.00	38.59	553.93	592.52
474.50	36.78	536.04	572.81
474.00	35.00	518.26	553.26

HA 97
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Seepage Analysis
Havana Power Station
East Ash Pond #3B

July 23, 2001
JHK

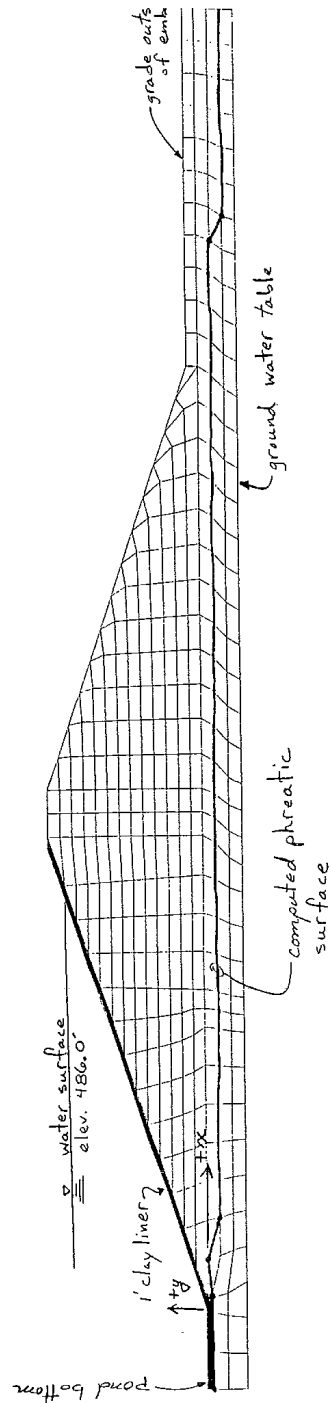
The new pond will have a polypropylene liner that is impermeable for practical purposes. Since there is no seepage under normal conditions, an "adverse" condition was analyzed to determine what would happen should the liner be damaged. The following calculations are for the full head of the pond being applied directly to the one-foot clay layer under the synthetic liner. This condition could occur if the liner were to have a significant tear or puncture.

The computer program Boss Seep2D was used to analyze the embankment of pond 2 for seepage. Pond 3B is adjacent to pond 2 and has similar properties to pond 2 with a smaller head, therefore Boss Seep2D was not run for pond 3B on the basis of comparison. The clay layer has a very low permeability compared to the sandy soils which form the embankment, and seepage through the clay flows nearly straight down to a phreatic surface elevation below the toe of the embankment. Therefore, seepage on the downstream face of the embankment should not occur, and a toe drain system is not needed. The Seep2D analysis for pond 2 is attached for reference.

HA 171

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Havana East Ash Pond #2
Seepage Analysis



HA 172

PLANE FLOW PROBLEM

Havana East Ash Pond #2

NUMBER OF NODAL POINTS-----393
NUMBER OF ELEMENTS-----359
NUMBER OF DIFF. MATERIALS--- 12
ELEVATION OF DATUM----- .000

AA 173

MATERIAL PROPERTIES

MAT	K1	K2	ANGLE	USPAR1	USPAR2
1	.1035E+01	.1035E+01	.0000E+00	.1000E-02	.0000E+00
2	.2628E+05	.2628E+05	.0000E+00	.1000E-02	.0000E+00
3	.0000E+00	.0000E+00	.0000E+00	.1000E-02	.0000E+00
4	.0000E+00	.0000E+00	.0000E+00	.1000E-02	.0000E+00
5	.0000E+00	.0000E+00	.0000E+00	.1000E-02	.0000E+00
6	.0000E+00	.0000E+00	.0000E+00	.1000E-02	.0000E+00
7	.0000E+00	.0000E+00	.0000E+00	.1000E-02	.0000E+00
8	.0000E+00	.0000E+00	.0000E+00	.1000E-02	.0000E+00

K_1, K_2 in ft/yr. in above table
Mat. #1 is clay @ 1.0×10^{-10} cm/sec permeability.
Mat. #2 is sand @ 2.54×10^{-2} cm/sec permeability.

DRAFT

9 .0000E+00 .0000E+00 .0000E+00 .1000E-02 .0000E+00
10 .0000E+00 .0000E+00 .0000E+00 .1000E-02 .0000E+00
11 .0000E+00 .0000E+00 .0000E+00 .1000E-02 .0000E+00
12 .0000E+00 .0000E+00 .0000E+00 .1000E-02 .0000E+00

NODE POINT INFORMATION

NODE	BC	X	Y	FLOW-HEAD
1	1	-20.00	.00	35.00
2	0	-20.00	-5.00	.00
3	0	-20.00	-10.00	.00
4	1	-10.00	.00	35.00
5	0	-10.26	-1.00	.00
6	0	-20.00	-1.00	.00
7	0	-10.74	-5.00	.00
8	0	-11.00	-10.00	.00
9	1	.00	.00	35.00
10	0	-1.52	-1.00	.00
11	0	-1.48	-5.00	.00
12	0	-2.00	-10.00	.00
13	1	8.75	2.92	35.00
14	0	11.95	2.92	.00
15	0	3.20	.00	.00
16	0	3.00	-1.00	.00
17	0	4.18	-5.00	.00
18	0	7.00	-10.00	.00
19	1	17.50	5.83	35.00
20	0	20.70	5.83	.00
21	0	21.63	2.92	.00
22	0	22.70	.00	.00
23	0	12.95	.00	.00
24	0	13.74	-3.33	.00
25	0	15.21	-6.67	.00

HA 174

DRAFT

26	0	16.00	-10.00	.00
27	1	26.25	8.75	35.00
28	0	29.45	8.75	.00
29	0	30.32	5.83	.00
30	0	31.30	2.92	.00
31	0	32.45	.00	.00
32	0	32.85	-3.33	.00
33	0	23.30	-3.33	.00
34	0	24.40	-6.67	.00
35	0	25.00	-10.00	.00
36	1	35.00	11.67	35.00
37	0	38.20	11.67	.00
38	0	39.00	8.75	.00
39	0	39.89	5.83	.00
40	0	40.93	2.92	.00
41	0	42.20	.00	.00
42	0	42.41	-3.33	.00
43	0	42.79	-6.67	.00
44	0	33.60	-6.67	.00
45	0	34.00	-10.00	.00
46	1	43.75	14.58	35.00
47	0	46.95	14.58	.00
48	0	47.68	11.67	.00
49	0	48.49	8.75	.00
50	0	49.41	5.83	.00
51	0	50.52	2.92	.00
52	0	51.95	.00	.00
53	0	51.96	-3.33	.00
54	0	51.99	-6.67	.00
55	0	52.00	-10.00	.00
56	0	43.00	-10.00	.00
57	1	52.50	17.50	35.00
58	0	55.70	17.50	.00
59	0	56.36	14.58	.00
60	0	57.08	11.67	.00
61	0	57.89	8.75	.00
62	0	58.83	5.83	.00
63	0	60.02	2.92	.00
64	0	61.70	.00	.00
65	0	61.52	-3.33	.00

NA 24
175

DRAFT

66	0	61.18	-6.67	.00
67	0	61.00	-10.00	.00
68	1	61.25	20.42	35.00
69	0	64.45	20.42	.00
70	0	65.04	17.50	.00
71	0	65.68	14.58	.00
72	0	66.37	11.67	.00
73	0	67.15	8.75	.00
74	0	68.10	5.83	.00
75	0	69.37	2.92	.00
76	0	71.45	.00	.00
77	0	71.07	-3.33	.00
78	0	70.38	-6.67	.00
79	0	70.00	-10.00	.00
80	1	70.00	23.33	35.00
81	0	73.20	23.33	.00
82	0	73.42	20.42	.00
83	0	73.66	17.50	.00
84	0	73.93	14.58	.00
85	0	74.25	11.67	.00
86	0	74.64	8.75	.00
87	0	75.21	5.83	.00
88	0	76.17	2.92	.00
89	0	76.32	.00	.00
90	0	75.85	-3.33	.00
91	0	74.97	-6.67	.00
92	0	74.50	-10.00	.00
93	1	78.75	26.25	35.00
94	0	81.95	26.25	.00
95	0	81.87	23.33	.00
96	0	81.78	20.42	.00
97	0	81.70	17.50	.00
98	0	81.62	14.58	.00
99	0	81.53	11.67	.00
100	0	81.45	8.75	.00
101	0	81.37	5.83	.00
102	0	81.28	2.92	.00
103	0	81.20	.00	.00
104	0	80.63	-3.33	.00
105	0	79.57	-6.67	.00

HA 176

DRAFT

106	0	79.00	-10.00	.00
107	1	87.50	29.17	35.00
108	0	90.70	29.17	.00
109	0	90.72	26.25	.00
110	0	90.75	23.33	.00
111	0	90.78	20.42	.00
112	0	90.80	17.50	.00
113	0	90.82	14.58	.00
114	0	90.85	11.67	.00
115	0	90.88	8.75	.00
116	0	90.90	5.83	.00
117	0	90.93	2.92	.00
118	0	90.95	.00	.00
119	0	90.18	-3.33	.00
120	0	88.76	-6.67	.00
121	0	88.00	-10.00	.00
122	1	96.25	32.08	35.00
123	0	99.45	32.08	.00
124	0	99.56	29.17	.00
125	0	99.68	26.25	.00
126	0	99.79	23.33	.00
127	0	99.90	20.42	.00
128	0	100.02	17.50	.00
129	0	100.13	14.58	.00
130	0	100.25	11.67	.00
131	0	100.36	8.75	.00
132	0	100.47	5.83	.00
133	0	100.59	2.92	.00
134	0	100.70	.00	.00
135	0	99.74	-3.33	.00
136	0	97.96	-6.67	.00
137	0	97.00	-10.00	.00
138	1	105.00	35.00	35.00
139	0	108.20	35.00	.00
140	0	108.39	32.08	.00
141	0	108.57	29.17	.00
142	0	108.76	26.25	.00
143	0	108.95	23.33	.00
144	0	109.14	20.42	.00
145	0	109.32	17.50	.00

HA 177

DRAFT

146	0	109.51	14.58	.00
147	0	109.70	11.67	.00
148	0	109.89	8.75	.00
149	0	110.07	5.83	.00
150	0	110.26	2.92	.00
151	0	110.45	.00	.00
152	0	109.30	-3.33	.00
153	0	107.15	-6.67	.00
154	0	106.00	-10.00	.00
155	1	117.00	39.00	35.00
156	0	120.20	39.00	.00
157	0	120.20	36.00	.00
158	0	120.20	33.00	.00
159	0	120.20	30.00	.00
160	0	120.20	27.00	.00
161	0	120.20	24.00	.00
162	0	120.20	21.00	.00
163	0	120.20	18.00	.00
164	0	120.20	15.00	.00
165	0	120.20	12.00	.00
166	0	120.20	9.00	.00
167	0	120.20	6.00	.00
168	0	120.20	3.00	.00
169	0	120.20	.00	.00
170	0	118.27	-3.33	.00
171	0	114.68	-6.67	.00
172	0	112.75	-10.00	.00
173	0	126.10	39.00	.00
174	0	126.10	36.00	.00
175	0	126.10	33.00	.00
176	0	126.10	30.00	.00
177	0	126.10	27.00	.00
178	0	126.10	24.00	.00
179	0	126.10	21.00	.00
180	0	126.10	18.00	.00
181	0	126.10	15.00	.00
182	0	126.10	12.00	.00
183	0	126.10	9.00	.00
184	0	126.10	6.00	.00
185	0	126.10	3.00	.00

HA 178

DRAFT

186	0	126.10	-0.00	.00
187	0	124.39	-3.33	.00
188	0	121.21	-6.67	.00
189	0	119.50	-10.00	.00
190	2	132.00	39.00	.00
191	0	132.00	36.00	.00
192	0	132.00	33.00	.00
193	0	132.00	30.00	.00
194	0	132.00	27.00	.00
195	0	132.00	24.00	.00
196	0	132.00	21.00	.00
197	0	132.00	18.00	.00
198	0	132.00	15.00	.00
199	0	132.00	12.00	.00
200	0	132.00	9.00	.00
201	0	132.00	6.00	.00
202	0	132.00	3.00	.00
203	0	132.00	.00	.00
204	0	130.51	-3.33	.00
205	0	127.74	-6.67	.00
206	0	126.25	-10.00	.00
207	2	140.31	36.23	.00
208	0	140.68	33.11	.00
209	0	140.71	30.10	.00
210	0	140.74	27.09	.00
211	0	140.77	24.08	.00
212	0	140.80	21.07	.00
213	0	140.83	18.06	.00
214	0	140.86	15.05	.00
215	0	140.88	12.04	.00
216	0	140.91	9.03	.00
217	0	140.94	6.02	.00
218	0	140.97	3.01	.00
219	0	141.00	.00	.00
220	0	138.93	-3.33	.00
221	0	135.07	-6.67	.00
222	0	133.00	-10.00	.00
223	2	148.62	33.46	.00
224	0	149.37	30.21	.00
225	0	149.43	27.19	.00

HA ~~178~~
179

DRAFT

226	0	149.50	24.17	.00
227	0	149.56	21.15	.00
228	0	149.62	18.13	.00
229	0	149.68	15.10	.00
230	0	149.75	12.08	.00
231	0	149.81	9.06	.00
232	0	149.87	6.04	.00
233	0	149.94	3.02	.00
234	0	150.00	.00	.00
235	0	147.93	-3.33	.00
236	0	144.07	-6.67	.00
237	0	142.00	-10.00	.00
238	2	156.92	30.69	.00
239	0	158.07	27.31	.00
240	0	158.17	24.28	.00
241	0	158.27	21.24	.00
242	0	158.38	18.21	.00
243	0	158.48	15.17	.00
244	0	158.59	12.14	.00
245	0	158.69	9.10	.00
246	0	158.79	6.07	.00
247	0	158.90	3.04	.00
248	0	159.00	.00	.00
249	0	156.93	-3.33	.00
250	0	153.07	-6.67	.00
251	0	151.00	-10.00	.00
252	2	165.23	27.92	.00
253	0	166.77	24.41	.00
254	0	166.92	21.36	.00
255	0	167.08	18.31	.00
256	0	167.23	15.26	.00
257	0	167.38	12.20	.00
258	0	167.54	9.15	.00
259	0	167.69	6.10	.00
260	0	167.85	3.05	.00
261	0	168.00	.00	.00
262	0	165.93	-3.33	.00
263	0	162.07	-6.67	.00
264	0	160.00	-10.00	.00
265	2	173.54	25.15	.00

HA 180

DRAFT

266	0	175.49	21.50	.00
267	0	175.70	18.43	.00
268	0	175.92	15.36	.00
269	0	176.13	12.29	.00
270	0	176.35	9.22	.00
271	0	176.57	6.14	.00
272	0	176.78	3.07	.00
273	0	177.00	.00	.00
274	0	174.93	-3.33	.00
275	0	171.07	-6.67	.00
276	0	169.00	-10.00	.00
277	2	181.85	22.39	.00
278	0	184.22	18.59	.00
279	0	184.52	15.49	.00
280	0	184.81	12.40	.00
281	0	185.11	9.30	.00
282	0	185.41	6.20	.00
283	0	185.70	3.10	.00
284	0	186.00	.00	.00
285	0	183.93	-3.33	.00
286	0	180.07	-6.67	.00
287	0	178.00	-10.00	.00
288	2	190.15	19.61	.00
289	0	192.98	15.67	.00
290	0	193.38	12.54	.00
291	0	193.79	9.40	.00
292	0	194.19	6.27	.00
293	0	194.60	3.13	.00
294	0	195.00	.00	.00
295	0	192.93	-3.33	.00
296	0	189.07	-6.67	.00
297	0	187.00	-10.00	.00
298	2	198.46	16.85	.00
299	0	201.79	12.74	.00
300	0	202.34	9.55	.00
301	0	202.89	6.37	.00
302	0	203.45	3.18	.00
303	0	204.00	.00	.00
304	0	201.93	-3.33	.00
305	0	198.07	-6.67	.00

HA 8/1
1821

DRAFT

306	0	196.00	-10.00	.00
307	2	206.77	14.08	.00
308	0	210.66	9.78	.00
309	0	211.44	6.52	.00
310	0	212.22	3.26	.00
311	0	213.00	.00	.00
312	0	210.93	-3.33	.00
313	0	207.07	-6.67	.00
314	0	205.00	-10.00	.00
315	2	215.08	11.31	.00
316	0	219.69	6.77	.00
317	0	220.85	3.38	.00
318	0	222.00	.00	.00
319	0	219.93	-3.33	.00
320	0	216.07	-6.67	.00
321	0	214.00	-10.00	.00
322	2	223.38	8.54	.00
323	0	229.10	3.63	.00
324	0	231.00	.00	.00
325	0	228.93	-3.33	.00
326	0	225.07	-6.67	.00
327	0	223.00	-10.00	.00
328	2	231.69	5.77	.00
329	0	240.00	.00	.00
330	0	237.93	-3.33	.00
331	0	234.07	-6.67	.00
332	0	232.00	-10.00	.00
333	2	240.00	3.00	.00
334	2	248.33	3.00	.00
335	0	248.33	.00	.00
336	0	246.43	-3.33	.00
337	0	242.90	-6.67	.00
338	0	241.00	-10.00	.00
339	2	256.67	3.00	.00
340	0	256.67	.00	.00
341	0	254.94	-3.33	.00
342	0	251.73	-6.67	.00
343	0	250.00	-10.00	.00
344	2	265.00	3.00	.00
345	0	265.00	.00	.00

HA 182

DRAFT

346	0	263.44	-3.33	.00
347	0	260.56	-6.67	.00
348	0	259.00	-10.00	.00
349	2	273.33	3.00	.00
350	0	273.33	.00	.00
351	0	271.95	-3.33	.00
352	0	269.38	-6.67	.00
353	0	288.00	-10.00	.00
354	2	281.67	3.00	.00
355	0	281.67	.00	.00
356	0	280.46	-3.33	.00
357	0	278.21	-6.67	.00
358	0	277.00	-10.00	.00
359	2	290.00	3.00	.00
360	0	290.00	.00	.00
361	0	288.96	-3.33	.00
362	0	287.04	-6.67	.00
363	0	286.00	-10.00	.00
364	2	298.33	3.00	.00
365	0	298.33	.00	.00
366	0	297.47	-3.33	.00
367	0	295.86	-6.67	.00
368	0	295.00	-10.00	.00
369	2	306.67	3.00	.00
370	0	306.67	.00	.00
371	0	305.98	-3.33	.00
372	0	304.69	-6.67	.00
373	0	304.00	-10.00	.00
374	2	315.00	3.00	.00
375	0	315.00	.00	.00
376	0	314.48	-3.33	.00
377	0	313.52	-6.67	.00
378	0	313.00	-10.00	.00
379	2	323.33	3.00	.00
380	0	323.33	.00	.00
381	0	322.99	-3.33	.00
382	0	322.35	-6.67	.00
383	0	322.00	-10.00	.00
384	2	331.67	3.00	.00
385	0	331.67	.00	.00

HA 183

DRAFT

386	0	331.49	-3.33	.00
387	0	331.17	-6.67	.00
388	0	331.00	-10.00	.00
389	2	340.00	3.00	.00
390	2	340.00	.00	.00
391	2	340.00	-3.33	.00
392	2	340.00	-6.67	.00
393	2	340.00	-10.00	.00

ELEMENT INFORMATION

ELMT	#1	#2	#3	#4	MAT	ANGLE
1	1	6	5	4	1	.0
2	6	2	7	5	2	.0
3	2	3	8	7	2	.0
4	4	5	10	9	1	.0
5	5	7	11	10	2	.0
6	7	8	12	11	2	.0
7	9	15	14	13	1	.0
8	9	10	16	15	1	.0
9	10	11	17	16	2	.0
10	11	12	18	17	2	.0
11	13	14	20	19	1	.0
12	21	20	14	14	2	.0
13	22	21	14	23	2	.0
14	23	14	15	15	2	.0
15	15	16	24	23	2	.0
16	16	17	25	24	2	.0
17	17	18	26	25	2	.0
18	19	20	28	27	1	.0
19	29	28	20	20	2	.0
20	30	29	20	21	2	.0
21	31	30	21	22	2	.0

HA 184

DRAFT

22	22	33	32	31	2	.0
23	23	24	33	22	2	.0
24	24	25	34	33	2	.0
25	25	26	35	34	2	.0
26	27	28	37	36	1	.0
27	28	37	28	28	2	.0
28	39	38	28	29	2	.0
29	40	39	29	30	2	.0
30	41	40	30	31	2	.0
31	31	32	42	41	2	.0
32	32	44	43	42	2	.0
33	33	34	44	32	2	.0
34	34	35	45	44	2	.0
35	36	37	47	46	1	.0
36	48	47	37	37	2	.0
37	49	48	37	38	2	.0
38	50	49	38	39	2	.0
39	51	50	39	40	2	.0
40	52	51	40	41	2	.0
41	41	42	53	52	2	.0
42	42	43	54	53	2	.0
43	43	56	55	54	2	.0
44	44	45	56	43	2	.0
45	46	47	58	57	1	.0
46	59	58	47	47	2	.0
47	60	59	47	48	2	.0
48	61	60	48	49	2	.0
49	62	61	49	50	2	.0
50	63	62	50	51	2	.0
51	64	63	51	52	2	.0
52	52	53	65	64	2	.0
53	53	54	66	65	2	.0
54	54	55	67	66	2	.0
55	57	58	69	68	1	.0
56	70	69	58	58	2	.0
57	71	70	58	59	2	.0
58	72	71	59	60	2	.0
59	73	72	60	61	2	.0
60	74	73	61	62	2	.0
61	75	74	62	63	2	.0

HA 99
18.5

DRAFT

62	76	75	63	64	2	.0
63	64	65	77	76	2	.0
64	65	66	78	77	2	.0
65	66	67	79	78	2	.0
66	68	69	81	80	1	.0
67	82	81	69	69	2	.0
68	83	82	69	70	2	.0
69	84	83	70	71	2	.0
70	85	84	71	72	2	.0
71	86	85	72	73	2	.0
72	87	86	73	74	2	.0
73	88	87	74	75	2	.0
74	89	88	75	76	2	.0
75	76	77	90	89	2	.0
76	77	78	91	90	2	.0
77	78	79	92	91	2	.0
78	80	81	94	93	1	.0
79	95	94	81	81	2	.0
80	96	95	81	82	2	.0
81	97	96	82	83	2	.0
82	98	97	83	84	2	.0
83	99	98	84	85	2	.0
84	100	99	85	86	2	.0
85	101	100	86	87	2	.0
86	102	101	87	88	2	.0
87	103	102	88	89	2	.0
88	89	90	104	103	2	.0
89	90	91	105	104	2	.0
90	91	92	106	105	2	.0
91	93	94	108	107	1	.0
92	109	108	94	94	2	.0
93	109	94	95	110	2	.0
94	110	95	96	111	2	.0
95	111	96	97	112	2	.0
96	112	97	98	113	2	.0
97	113	98	99	114	2	.0
98	114	99	100	115	2	.0
99	115	100	101	116	2	.0
100	116	101	102	117	2	.0
101	117	102	103	118	2	.0

HA 186

[illegible]

HA ~~100~~
127

DRAFT

142	161	143	144	162	2	.0
143	162	144	145	163	2	.0
144	163	145	146	164	2	.0
145	164	146	147	165	2	.0
146	165	147	148	166	2	.0
147	166	148	149	167	2	.0
148	167	149	150	168	2	.0
149	168	150	151	169	2	.0
150	151	152	170	169	2	.0
151	152	153	171	170	2	.0
152	153	154	172	171	2	.0
153	154	155	173	172	2	.0
154	155	156	174	173	2	.0
155	156	157	175	174	2	.0
156	157	158	176	175	2	.0
157	158	159	177	176	2	.0
158	159	160	178	177	2	.0
159	160	161	179	178	2	.0
160	161	162	180	179	2	.0
161	162	163	181	180	2	.0
162	163	164	182	181	2	.0
163	164	165	183	182	2	.0
164	165	166	184	183	2	.0
165	166	167	185	184	2	.0
166	167	168	186	185	2	.0
167	168	169	187	186	2	.0
168	169	170	188	187	2	.0
169	170	171	189	188	2	.0
170	171	172	190	189	2	.0
171	172	173	191	190	2	.0
172	173	174	192	191	2	.0
173	174	175	193	192	2	.0
174	175	176	194	193	2	.0
175	176	177	195	194	2	.0
176	177	178	196	195	2	.0
177	178	179	197	196	2	.0
178	179	180	198	197	2	.0
179	180	181	199	198	2	.0
180	181	182	200	199	2	.0
181	182	183	201	200	2	.0
182	183	184	202	201	2	.0
183	184	185	203	202	2	.0
184	185	186		203	2	.0
185	186					
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HA 188

DRAFT

182	186	187	204	203	2	.0
183	187	188	205	204	2	.0
184	188	189	206	205	2	.0
185	191	207	190	190	2	.0
186	192	208	207	191	2	.0
187	193	209	208	192	2	.0
188	194	210	209	193	2	.0
189	195	211	210	194	2	.0
190	196	212	211	195	2	.0
191	197	213	212	196	2	.0
192	198	214	213	197	2	.0
193	199	215	214	198	2	.0
194	200	216	215	199	2	.0
195	201	217	216	200	2	.0
196	202	218	217	201	2	.0
197	203	219	218	202	2	.0
198	204	220	219	203	2	.0
199	205	221	220	204	2	.0
200	206	222	221	205	2	.0
201	208	223	207	207	2	.0
202	209	224	223	208	2	.0
203	210	225	224	209	2	.0
204	211	226	225	210	2	.0
205	212	227	226	211	2	.0
206	213	228	227	212	2	.0
207	214	229	228	213	2	.0
208	215	230	229	214	2	.0
209	216	231	230	215	2	.0
210	217	232	231	216	2	.0
211	218	233	232	217	2	.0
212	219	234	233	218	2	.0
213	219	220	235	234	2	.0
214	220	221	236	235	2	.0
215	221	222	237	236	2	.0
216	224	238	223	223	2	.0
217	225	239	238	224	2	.0
218	226	240	239	225	2	.0
219	227	241	240	226	2	.0
220	228	242	241	227	2	.0
221	229	243	242	228	2	.0

HA ☒ 189

DRAFT

222	230	244	243	229	2	.0
223	231	245	244	230	2	.0
224	232	246	245	231	2	.0
225	233	247	246	232	2	.0
226	234	248	247	233	2	.0
227	235	249	248	234	2	.0
228	236	250	249	235	2	.0
229	237	251	250	236	2	.0
230	238	252	251	237	2	.0
231	239	253	252	238	2	.0
232	240	254	253	239	2	.0
233	241	255	254	240	2	.0
234	242	256	255	241	2	.0
235	243	257	256	242	2	.0
236	244	258	257	243	2	.0
237	245	259	258	244	2	.0
238	246	260	259	245	2	.0
239	247	261	260	246	2	.0
240	248	262	261	247	2	.0
241	249	263	262	248	2	.0
242	250	264	263	249	2	.0
243	251	265	264	250	2	.0
244	252	266	265	251	2	.0
245	253	267	266	252	2	.0
246	254	268	267	253	2	.0
247	255	269	268	254	2	.0
248	256	270	269	255	2	.0
249	257	271	270	256	2	.0
250	258	272	271	257	2	.0
251	259	273	272	258	2	.0
252	260	274	273	259	2	.0
253	261	275	274	260	2	.0
254	262	276	275	261	2	.0
255	263	277	276	262	2	.0
256	264	278	277	263	2	.0
257	265	279	278	264	2	.0
258	266	280	279	265	2	.0
259	267	281	280	266	2	.0
260	268	282	281	267	2	.0
261	269	283	282	268	2	.0
	270		283	269	2	.0
	271			270	2	.0
	272			271	2	.0

HA 190

262	273	284	283	272	2	.0
263	273	274	285	284	2	.0
264	274	275	286	285	2	.0
265	275	276	287	286	2	.0
266	278	288	277	277	2	.0
267	279	289	288	278	2	.0
268	280	290	289	279	2	.0
269	281	291	290	280	2	.0
270	282	292	291	281	2	.0
271	283	293	292	282	2	.0
272	284	294	293	283	2	.0
273	284	285	295	294	2	.0
274	285	286	296	295	2	.0
275	286	287	297	296	2	.0
276	289	298	288	288	2	.0
277	290	299	289	289	2	.0
278	291	300	299	290	2	.0
279	292	301	300	291	2	.0
280	293	302	301	292	2	.0
281	294	303	302	293	2	.0
282	294	295	304	303	2	.0
283	295	296	305	304	2	.0
284	296	297	306	305	2	.0
285	299	307	298	298	2	.0
286	300	308	307	299	2	.0
287	301	309	308	300	2	.0
288	302	310	309	301	2	.0
289	303	311	310	302	2	.0
290	303	304	312	311	2	.0
291	304	305	313	312	2	.0
292	305	306	314	313	2	.0
293	308	315	307	307	2	.0
294	309	316	315	308	2	.0
295	310	317	316	309	2	.0
296	311	318	317	310	2	.0
297	311	312	319	318	2	.0
298	312	313	320	319	2	.0
299	313	314	321	320	2	.0
300	316	322	315	315	2	.0
301	317	323	322	316	2	.0

HA 191

DRAFT

302	318	324	323	317	2	.0
303	319	319	325	324	2	.0
304	319	320	326	325	2	.0
305	320	321	327	326	2	.0
306	323	328	322	322	2	.0
307	324	329	328	323	2	.0
308	324	325	330	329	2	.0
309	325	326	331	330	2	.0
310	326	327	332	331	2	.0
311	329	333	328	328	2	.0
312	333	329	335	334	2	.0
313	329	330	336	335	2	.0
314	330	331	337	336	2	.0
315	331	332	338	337	2	.0
316	334	335	340	339	2	.0
317	335	336	341	340	2	.0
318	336	337	342	341	2	.0
319	337	338	343	342	2	.0
320	339	340	345	344	2	.0
321	340	341	346	345	2	.0
322	341	342	347	346	2	.0
323	342	343	348	347	2	.0
324	344	345	350	349	2	.0
325	345	346	351	350	2	.0
326	346	347	352	351	2	.0
327	347	348	353	352	2	.0
328	349	350	355	354	2	.0
329	350	351	356	355	2	.0
330	351	352	357	356	2	.0
331	352	353	358	357	2	.0
332	354	355	360	359	2	.0
333	355	356	361	360	2	.0
334	356	357	362	361	2	.0
335	357	358	363	362	2	.0
336	359	360	365	364	2	.0
337	360	361	366	365	2	.0
338	361	362	367	366	2	.0
339	362	363	368	367	2	.0
340	364	365	370	369	2	.0
341	365	366	371	370	2	.0

HA 192

HA ~~B~~
193

POSITION OF PHREATIC SURFACE

NODE	HEAD	PERCENTAGE OF AVAILABLE HEAD	FLOW	ABOVE	ON	BELOW	X	Y
1	.3500E+02	91.8 %	.1970E+03			*		
2	-.3062E+01	14.2 %				*		

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3.34	33	-.3251E+01	13.8 %	*	23.28	-
3.25	34	-.3264E+01	13.7 %	*		
	35	-.3269E+01	13.7 %	*		
	36	.3500E+02	91.8 %	*		
	37	.1167E+02	44.2 %	*	36.95	
11.67	38			*		
	39			*		
	40			*		
	41			*		
3.43	42	-.3430E+01	13.4 %	*	42.42	-
	43	-.3435E+01	13.4 %	*		
	44	-.3346E+01	13.6 %	*		
	45	-.3350E+01	13.6 %	*		
	46	.3500E+02	91.8 %	*		
14.58	47	.11458E+02	50.2 %	*	45.45	
	48			*		
	49			*		
	50			*		
	51			*		
	52			*		
3.53	53	-.3528E+01	13.2 %	*	51.96	-
	54	-.3530E+01	13.2 %	*		
	55	-.3531E+01	13.2 %	*		
	56	-.3437E+01	13.4 %	*		
	57	.3500E+02	91.8 %	*		
17.50	58	.1750E+02	56.1 %	*	53.95	
	59			*		
	60			*		
	61			*		
	62			*		
	63			*		
	64			*		
	65	-.3638E+01	13.0 %	*	61.49	-

HA 195

HA 196

1. The first step is to identify the problem or goal. This involves understanding the current situation and what needs to be achieved.

74A ~~13~~
197

A-229

DRAFT

4.07	135	-.4074E+01	12.1 %	*	99.34	-
	136	-.4058E+01	12.1 %	*		
	137	-.4047E+01	12.1 %	*		
35.00	138	.3500E+02	91.8 %	*	105.00	
	139			*		
	140			*		
	141			*		
	142			*		
	143			*		
	144			*		
	145			*		
	146			*		
	147			*		
	148			*		
	149			*		
	150			*		
	151			*		
4.18	152	-.4182E+01	11.9 %	*	108.75	-
	153	-.4163E+01	11.9 %	*		
	154	-.4150E+01	11.9 %	*		
	155			*		
	156			*		
	157			*		
	158			*		
	159			*		
	160			*		
	161			*		
	162			*		
	163			*		
	164			*		
	165			*		
	166			*		
	167			*		
	168			*		
	169			*		
4.28	170	-.4278E+01	11.7 %	*	117.25	-

HA 190

DRAFT

171	-.4249E+01	11.7 %	*		
172	-.4227E+01	11.8 %	*		
173			*		
174			*		
175			*		
176			*		
177			*		
178			*		
179			*		
180			*		
181			*		
182			*		
183			*		
184			*		
185			*		
186			*		
187	-.4347E+01	11.5 %	*	123.42	-
188					
189	-.4323E+01	11.6 %	*		
190	-.4304E+01	11.6 %	*		
191			*		
192			*		
193			*		
194			*		
195			*		
196			*		
197			*		
198			*		
199			*		
200			*		
201			*		
202			*		
203			*		
204	-.4419E+01	11.4 %	*	129.61	-
205	-.4398E+01	11.4 %	*		
206	-.4381E+01	11.5 %	*		
207			*		
208			*		

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HP 199

HA 200


[illegible]

HA  201

A-233

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14A 
203

A-235

DRAFT

6.70	353	-.6666E+01	6.8 %	*	*	-
	354			*	*	
	355			*	*	
	356			*	*	
	357	-.6897E+01	6.3 %	*	*	278.13
6.90	358	-.6872E+01	6.4 %	*	*	
	359			*	*	
	360			*	*	
	361			*	*	
	362	-.7124E+01	5.9 %	*	*	286.89
7.12	363	-.7101E+01	5.9 %	*	*	
	364			*	*	
	365			*	*	
	366			*	*	
	367	-.7369E+01	5.4 %	*	*	295.68
7.37	368	-.7351E+01	5.4 %	*	*	
	369			*	*	
	370			*	*	
	371			*	*	
	372	-.7625E+01	4.8 %	*	*	304.49
7.63	373	-.7608E+01	4.9 %	*	*	
	374			*	*	
	375			*	*	
	376			*	*	
	377	-.7914E+01	4.3 %	*	*	313.32
7.91	378	-.7908E+01	4.3 %	*	*	
	379			*	*	
	380			*	*	
	381			*	*	
	382	-.8336E+01	3.4 %	*	*	322.17
8.34	383	-.8336E+01	3.4 %	*	*	
	384			*	*	
	385			*	*	

HA 204

FLOW(-) =	4.7972E+03	FLOW(+) =	4.7964E+03
		FLOW(AVE) =	4.7968E+03

ELMT	V1	V2	P-AXIS	ANG	RES	V	DIR OF V
1	.491E-03	-.394E+02	.000E+00		.394E+02		-.900E+02
2	.125E+02	-.138E+05	.000E+00		.138E+05		-.899E+02
3	.258E+02	-.142E+02	.000E+00		.295E+02		-.289E+02
4	.183E-02	-.394E+02	.000E+00		.394E+02		-.900E+02
5	.378E+02	-.139E+05	.000E+00		.139E+05		-.898E+02
6	.760E+02	-.114E+02	.000E+00		.769E+02		-.850E+01
7	.123E+02	-.370E+02	.000E+00		.390E+02		-.716E+02
8	.242E+01	-.985E+01	.000E+00		.101E+02		-.762E+02
9	.371E+04	-.984E+04	.000E+00		.105E+05		-.693E+02
10	.121E+03	-.193E+02	.000E+00		.123E+03		-.902E+01
11	.123E+02	-.370E+02	.000E+00		.390E+02		-.716E+02

15	.791E+01	-.250E+05	.000E+00	.250E+05	-.900E+02
16	.164E+03	-.477E+02	.000E+00	.171E+03	-.162E+02
17	.164E+03	-.747E+01	.000E+00	.165E+03	-.260E+01
18	.123E+02	-.370E+02	.000E+00	.390E+02	-.716E+02
23	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
24	.200E+03	-.191E+02	.000E+00	.201E+03	-.546E+01
25	.205E+03	-.612E+01	.000E+00	.205E+03	-.171E+01
26	.124E+02	-.371E+02	.000E+00	.391E+02	-.716E+02
32	.256E+03	-.902E+01	.000E+00	.256E+03	-.202E+01
33	.235E+03	-.167E+02	.000E+00	.236E+03	-.407E+01
34	.235E+03	-.436E+01	.000E+00	.235E+03	-.106E+01
35	.124E+02	-.373E+02	.000E+00	.393E+02	-.716E+02
42	.271E+03	-.120E+02	.000E+00	.271E+03	-.252E+01
43	.274E+03	-.395E+01	.000E+00	.274E+03	-.826E+00
44	.256E+03	-.319E+01	.000E+00	.256E+03	-.715E+00
45	.125E+02	-.373E+02	.000E+00	.394E+02	-.716E+02
53	.300E+03	-.887E+01	.000E+00	.300E+03	-.169E+01
54	.296E+03	-.277E+01	.000E+00	.296E+03	-.535E+00
55	.125E+02	-.374E+02	.000E+00	.395E+02	-.716E+02
64	.302E+03	-.794E+00	.000E+00	.302E+03	-.151E+00
65	.302E+03	-.298E+00	.000E+00	.302E+03	-.565E-01
66	.125E+02	-.376E+02	.000E+00	.396E+02	-.716E+02
76	.303E+03	-.105E+01	.000E+00	.303E+03	-.197E+00
77	.303E+03	-.244E+00	.000E+00	.303E+03	-.462E-01
78	.126E+02	-.377E+02	.000E+00	.397E+02	-.716E+02
89	.304E+03	-.637E-01	.000E+00	.304E+03	-.120E-01
90	.304E+03	-.117E+00	.000E+00	.304E+03	-.220E-01
91	.126E+02	-.378E+02	.000E+00	.398E+02	-.716E+02
103	.304E+03	.544E+00	.000E+00	.304E+03	.103E+00
104	.303E+03	.841E-01	.000E+00	.303E+03	.159E-01
105	.126E+02	-.379E+02	.000E+00	.399E+02	-.716E+02
118	.302E+03	.113E+01	.000E+00	.302E+03	.215E+00
119	.302E+03	.230E+00	.000E+00	.302E+03	.435E-01
134	.301E+03	.133E+01	.000E+00	.301E+03	.253E+00
135	.301E+03	.335E+00	.000E+00	.301E+03	.638E-01
151	.299E+03	.144E+01	.000E+00	.299E+03	.277E+00
152	.299E+03	.238E+00	.000E+00	.299E+03	.456E-01
167	.297E+03	-.216E+01	.000E+00	.297E+03	-.418E+00
168	.299E+03	.339E+00	.000E+00	.299E+03	.651E-01
183	.301E+03	-.721E+01	.000E+00	.301E+03	-.137E+01

HA 206

184	.301E+03	-.340E+01	.000E+00	.301E+03	-.648E+00
199	.348E+03	-.187E+02	.000E+00	.348E+03	-.307E+01
200	.335E+03	-.801E+01	.000E+00	.335E+03	-.137E+01
214	.350E+03	-.396E+01	.000E+00	.350E+03	-.647E+00
215	.351E+03	-.140E+01	.000E+00	.351E+03	-.229E+00
228	.353E+03	-.105E+02	.000E+00	.353E+03	-.171E+01
229	.353E+03	-.688E-01	.000E+00	.353E+03	-.112E-01
241	.357E+03	-.110E+02	.000E+00	.357E+03	-.177E+01
242	.356E+03	-.923E+00	.000E+00	.356E+03	-.148E+00
253	.363E+03	-.142E+02	.000E+00	.363E+03	-.224E+01
254	.362E+03	-.102E+01	.000E+00	.362E+03	-.161E+00
264	.370E+03	-.165E+02	.000E+00	.370E+03	-.256E+01
265	.368E+03	-.126E+01	.000E+00	.368E+03	-.196E+00
274	.376E+03	-.151E+02	.000E+00	.376E+03	-.230E+01
275	.375E+03	-.123E+01	.000E+00	.375E+03	-.189E+00
283	.382E+03	-.131E+02	.000E+00	.382E+03	-.196E+01
284	.381E+03	-.934E+00	.000E+00	.381E+03	-.141E+00
291	.387E+03	.498E+01	.000E+00	.387E+03	.736E+00
292	.384E+03	-.952E+00	.000E+00	.384E+03	-.142E+00
298	.422E+03	.146E+02	.000E+00	.422E+03	.198E+01
299	.414E+03	-.790E+01	.000E+00	.414E+03	-.109E+01
304	.488E+03	-.328E+02	.000E+00	.488E+03	-.384E+01
305	.479E+03	-.127E+02	.000E+00	.479E+03	-.152E+01
309	.499E+03	-.472E+02	.000E+00	.499E+03	-.541E+01
310	.499E+03	-.238E+00	.000E+00	.499E+03	-.274E-01
314	.509E+03	-.635E+02	.000E+00	.509E+03	-.712E+01
315	.508E+03	-.220E+01	.000E+00	.508E+03	-.249E+00
318	.515E+03	-.777E+02	.000E+00	.515E+03	-.858E+01
319	.514E+03	-.631E+00	.000E+00	.514E+03	-.703E-01
322	.525E+03	-.901E+02	.000E+00	.525E+03	-.975E+01
323	.524E+03	-.544E+01	.000E+00	.524E+03	-.595E+00
327	.585E+03	-.146E+02	.000E+00	.585E+03	-.145E+01
331	.600E+03	-.151E+01	.000E+00	.600E+03	-.144E+00
335	.673E+03	-.169E+02	.000E+00	.673E+03	-.144E+01
339	.733E+03	-.135E+02	.000E+00	.733E+03	-.105E+01
343	.758E+03	.681E+01	.000E+00	.758E+03	.515E+00
347	.866E+03	-.201E+02	.000E+00	.867E+03	-.133E+01
351	.125E+04	-.117E+03	.000E+00	.126E+04	-.535E+01
355	.143E+04	-.296E+02	.000E+00	.143E+04	-.118E+01
359	.228E+04	-.890E+04	.000E+00	.919E+04	-.757E+02

HA 207

NODAL FLOWS AND HEADS

NODE	HEAD	PERCENTAGE OF AVAILABLE HEAD	FLOW
1	.1390E+03	3.0 %	-.1000E+03
2	.1390E+03	3.0 %	-.2063E-01
3	.1390E+03	3.0 %	-.1693E-01
4	.2430E+04	50.7 %	
5	.2372E+04	49.4 %	
6	.1390E+03	3.0 %	-.1088E+03
7	.1301E+04	27.2 %	
8	.1390E+03	3.0 %	-.7839E-01
9	.4693E+04	97.7 %	
10	.2539E+04	52.9 %	
11	.1390E+03	3.0 %	-.1601E+00
12	.4792E+04	99.7 %	
13	.4774E+04	99.4 %	-.5302E+02
14	.4774E+04	99.4 %	.2516E+03
15	.4804E+04	100.0 %	
16	.3409E+04	71.0 %	
17	.1390E+03	3.0 %	-.2178E+00
18	.4769E+04	99.3 %	
19	.4774E+04	99.4 %	.1336E+02
20			

HA 208

21	.2917E+01	.2	.0000E+00
22	-.3251E+01	.1	.0000E+00
23	.4774E+04	99.4	.2520E+00
24	.4594E+04	95.6	
25	.2400E+04	50.0	
26	.1390E+03	3.0	
27	.4775E+04	99.4	-.2317E+00
28	.4774E+04	99.4	
29	.5833E+01	.3	-.3379E+01
30	.2917E+01	.2	.0000E+00
31	.0000E+00	.1	.0000E+00
32	.4774E+04	99.4	.0000E+00
33	.4774E+04	99.4	.2534E+00
34	.2426E+04	50.6	.2501E+00
35	.1390E+03	3.0	
36	.4773E+04	99.4	-.2354E+00
37	.4774E+04	99.4	
38	.8750E+01	.3	.8755E+00
39	.5833E+01	.3	.0000E+00
40	.2917E+01	.2	.0000E+00
41	.0000E+00	.1	.0000E+00
42	.4774E+04	99.4	.2565E+00
43	.2491E+04	51.9	
44	.2461E+04	51.3	
45	.1390E+03	3.0	
46	.4774E+04	99.4	
47	.4774E+04	99.4	
48	.1167E+02	.4	
49	.8750E+01	.3	-.2386E+00
50	.5833E+01	.3	
51	.2917E+01	.2	
52	.0000E+00	.1	
53	.4774E+04	99.4	
54	.2526E+04	52.6	
55	.1390E+03	3.0	
56	.1390E+03	3.0	
57	.4774E+04	99.4	
58	.4774E+04	99.4	
59	.1458E+02	.4	.4805E-01
60	.1167E+02	.4	.0000E+00

HA# 209

61	.8750E+01	.3 %	.0000E+00
62	.5833E+01	.3 %	.0000E+00
63	.2917E+01	.2 %	.0000E+00
64	.0000E+00	.1 %	.0000E+00
65	.4774E+04	99.4 %	.2637E+00
66	.2566E+04	53.5 %	
67	.1390E+03	3.0 %	-.2493E+00
68	.4774E+04	99.4 %	
69	.4774E+04	99.4 %	
70	.1750E+02	.5 %	-.1682E-01
71	.1458E+02	.4 %	.0000E+00
72	.1167E+02	.4 %	.0000E+00
73	.8750E+01	.3 %	.0000E+00
74	.5833E+01	.3 %	.0000E+00
75	.2917E+01	.2 %	.0000E+00
76	.0000E+00	.1 %	.0000E+00
77	.4774E+04	99.4 %	.2002E+00
78	.2607E+04	54.3 %	
79	.1390E+03	3.0 %	-.1895E+00
80	.4774E+04	99.4 %	
81	.4774E+04	99.4 %	
82	.2042E+02	.6 %	
83	.1750E+02	.5 %	.1036E-01
84	.1458E+02	.4 %	.0000E+00
85	.1167E+02	.4 %	.0000E+00
86	.8750E+01	.3 %	.0000E+00
87	.5833E+01	.3 %	.0000E+00
88	.2917E+01	.2 %	.0000E+00
89	.0000E+00	.1 %	.0000E+00
90	.4774E+04	99.4 %	.1348E+00
91	.2628E+04	54.8 %	
92	.1390E+03	3.0 %	-.1277E+00
93	.4774E+04	99.4 %	
94	.4774E+04	99.4 %	-.2369E-01
95	.2333E+02	.6 %	.0000E+00
96	.2042E+02	.6 %	.0000E+00
97	.1750E+02	.5 %	.0000E+00
98	.1458E+02	.4 %	.0000E+00
99	.1167E+02	.4 %	.0000E+00
100	.8750E+01	.3 %	.0000E+00

HA 210

101	.5833E+01	.3	.0000E+00
102	.2917E+01	.2	.0000E+00
103	.0000E+00	.1	.0000E+00
104	.4774E+04	99.4	.2042E+00
105	.2649E+04	55.2	
106	.1390E+03	3.0	-.1939E+00
107	.4774E+04	99.4	
108	.4774E+04	99.4	
109	.2625E+02	.7	.3903E-01
110	.2333E+02	.6	.0000E+00
111	.2042E+02	.6	.0000E+00
112	.1750E+02	.5	.0000E+00
113	.1458E+02	.4	.0000E+00
114	.1167E+02	.4	.0000E+00
115	.8750E+01	.3	.0000E+00
116	.5833E+01	.3	.0000E+00
117	.2917E+01	.2	.0000E+00
118	.0000E+00	.1	.0000E+00
119	.4774E+04	99.4	.2759E+00
120	.2693E+04	56.1	-.2621E+00
121	.1390E+03	3.0	-.7353E-01
122	.4774E+04	99.4	.0000E+00
123	.3208E+02	.8	.0000E+00
124	.2917E+02	.7	.0000E+00
125	.2625E+02	.7	.0000E+00
126	.2333E+02	.6	.0000E+00
127	.2042E+02	.6	.0000E+00
128	.1750E+02	.5	.0000E+00
129	.1458E+02	.4	.0000E+00
130	.1167E+02	.4	.0000E+00
131	.8750E+01	.3	.0000E+00
132	.5833E+01	.3	.0000E+00
133	.2917E+01	.2	.0000E+00
134	.0000E+00	.1	.0000E+00
135	.4774E+04	99.4	.0000E+00
136	.2739E+04	57.1	.2803E+00
137	.1390E+03	3.0	
138	.3500E+02	.9	-.2666E+00
139	.3500E+02	.9	.0000E+00
140	.3208E+02	.8	.0000E+00

HA
211

141	.2917E+02	.7 %	.0000E+00
142	.2625E+02	.7 %	.0000E+00
143	.2333E+02	.6 %	.0000E+00
144	.2042E+02	.6 %	.0000E+00
145	.1750E+02	.5 %	.0000E+00
146	.1458E+02	.4 %	.0000E+00
147	.1167E+02	.4 %	.0000E+00
148	.8750E+01	.3 %	.0000E+00
149	.5833E+01	.3 %	.0000E+00
150	.2917E+01	.2 %	.0000E+00
151	.0000E+00	.1 %	.0000E+00
152	.4774E+04	99.4 %	.2712E+00
153	.2786E+04	58.0 %	
154	.1390E+03	3.0 %	-.2371E+00
155	.3900E+02	.9 %	.0000E+00
156	.3900E+02	.9 %	.0000E+00
157	.3600E+02	.9 %	.0000E+00
158	.3300E+02	.8 %	.0000E+00
159	.3000E+02	.8 %	.0000E+00
160	.2700E+02	.7 %	.0000E+00
161	.2400E+02	.6 %	.0000E+00
162	.2100E+02	.6 %	.0000E+00
163	.1800E+02	.5 %	.0000E+00
164	.1500E+02	.4 %	.0000E+00
165	.1200E+02	.4 %	.0000E+00
166	.9000E+01	.3 %	.0000E+00
167	.6000E+01	.3 %	.0000E+00
168	.3000E+01	.2 %	.0000E+00
169	.0000E+00	.1 %	.0000E+00
170	.4774E+04	99.4 %	.2258E+00
171	.2825E+04	58.9 %	
172	.1390E+03	3.0 %	-.2062E+00
173	.3900E+02	.9 %	.0000E+00
174	.3600E+02	.9 %	.0000E+00
175	.3300E+02	.8 %	.0000E+00
176	.3000E+02	.8 %	.0000E+00
177	.2700E+02	.7 %	.0000E+00
178	.2400E+02	.6 %	.0000E+00
179	.2100E+02	.6 %	.0000E+00
180	.1800E+02	.5 %	.0000E+00

HA 212

181	.1500E+02	.4	.0000E+00
182	.1200E+02	.4	.0000E+00
183	.9000E+01	.3	.0000E+00
184	.6000E+01	.3	.0000E+00
185	.3000E+01	.2	.0000E+00
186	.0000E+00	.1	.0000E+00
187	.4774E+04	99.4	.1928E+00
188	.2860E+04	59.6	
189	.1390E+03	3.0	-.2090E+00
190	.3900E+02	.9	.0000E+00
191	.3600E+02	.9	.0000E+00
192	.3300E+02	.8	.0000E+00
193	.3000E+02	.8	.0000E+00
194	.2700E+02	.7	.0000E+00
195	.2400E+02	.6	.0000E+00
196	.2100E+02	.6	.0000E+00
197	.1800E+02	.5	.0000E+00
198	.1500E+02	.4	.0000E+00
199	.1200E+02	.4	.0000E+00
200	.9000E+01	.3	.0000E+00
201	.6000E+01	.3	.0000E+00
202	.3000E+01	.2	.0000E+00
203	.0000E+00	.1	.0000E+00
204	.4774E+04	99.4	.2234E+00
205	.2896E+04	60.3	
206	.1390E+03	3.0	-.2119E+00
207	.3623E+02	.9	.0000E+00
208	.3311E+02	.8	.0000E+00
209	.3010E+02	.8	.0000E+00
210	.2709E+02	.7	.0000E+00
211	.2408E+02	.6	.0000E+00
212	.2107E+02	.6	.0000E+00
213	.1806E+02	.5	.0000E+00
214	.1505E+02	.4	.0000E+00
215	.1204E+02	.4	.0000E+00
216	.9029E+01	.3	.0000E+00
217	.6019E+01	.3	.0000E+00
218	.3010E+01	.2	.0000E+00
219	.0000E+00	.1	.0000E+00
220	.4774E+04	99.4	.2709E+00

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221	.2943E+04	61.3 %	-.2514E+00
222	.1390E+03	3.0 %	.0000E+00
223	.3346E+02	.8 %	.0000E+00
224	.3021E+02	.8 %	.0000E+00
225	.2719E+02	.7 %	.0000E+00
226	.2417E+02	.6 %	.0000E+00
227	.2115E+02	.6 %	.0000E+00
228	.1813E+02	.5 %	.0000E+00
229	.1510E+02	.4 %	.0000E+00
230	.1208E+02	.4 %	.0000E+00
231	.9063E+01	.3 %	.0000E+00
232	.6042E+01	.3 %	.0000E+00
233	.3021E+01	.2 %	.0000E+00
234	.0000E+00	.1 %	.0000E+00
235	.4774E+04	99.4 %	.2919E+00
236	.3006E+04	62.6 %	-.2931E+00
237	.1390E+03	3.0 %	.0000E+00
238	.3069E+02	.8 %	.0000E+00
239	.2731E+02	.7 %	.0000E+00
240	.2428E+02	.6 %	.0000E+00
241	.2124E+02	.6 %	.0000E+00
242	.1821E+02	.5 %	.0000E+00
243	.1517E+02	.5 %	.0000E+00
244	.1214E+02	.4 %	.0000E+00
245	.9104E+01	.3 %	.0000E+00
246	.6069E+01	.3 %	.0000E+00
247	.3035E+01	.2 %	.0000E+00
248	.0000E+00	.1 %	.0000E+00
249	.4774E+04	99.4 %	.2985E+00
250	.3072E+04	64.0 %	-.2998E+00
251	.1390E+03	3.0 %	.0000E+00
252	.2792E+02	.7 %	.0000E+00
253	.2441E+02	.6 %	.0000E+00
254	.2136E+02	.6 %	.0000E+00
255	.1831E+02	.5 %	.0000E+00
256	.1526E+02	.5 %	.0000E+00
257	.1220E+02	.4 %	.0000E+00
258	.9154E+01	.3 %	.0000E+00
259	.6103E+01	.3 %	.0000E+00
260	.3051E+01	.2 %	.0000E+00

HA 214

261	.0000E+00	.1 %	.0000E+00
262	.4774E+04	99.4 %	.3054E+00
263	.3142E+04	65.4 %	
264	.1390E+03	3.0 %	-.3069E+00
265	.2515E+02	.7 %	.0000E+00
266	.2150E+02	.6 %	.0000E+00
267	.1843E+02	.5 %	.0000E+00
268	.1536E+02	.5 %	.0000E+00
269	.1229E+02	.4 %	.0000E+00
270	.9216E+01	.3 %	.0000E+00
271	.6144E+01	.3 %	.0000E+00
272	.3072E+01	.2 %	.0000E+00
273	.0000E+00	.1 %	.0000E+00
274	.4774E+04	99.4 %	.3128E+00
275	.3216E+04	67.0 %	
276	.1390E+03	3.0 %	-.3144E+00
277	.2239E+02	.6 %	.0000E+00
278	.1859E+02	.5 %	.0000E+00
279	.1549E+02	.5 %	.0000E+00
280	.1240E+02	.4 %	.0000E+00
281	.9297E+01	.3 %	.0000E+00
282	.6198E+01	.3 %	.0000E+00
283	.3099E+01	.2 %	.0000E+00
284	.0000E+00	.1 %	.0000E+00
285	.4774E+04	99.4 %	.3208E+00
286	.3295E+04	68.6 %	
287	.1390E+03	3.0 %	-.3225E+00
288	.1961E+02	.5 %	.0000E+00
289	.1567E+02	.5 %	.0000E+00
290	.1254E+02	.4 %	.0000E+00
291	.9404E+01	.3 %	.0000E+00
292	.6269E+01	.3 %	.0000E+00
293	.3135E+01	.2 %	.0000E+00
294	.0000E+00	.1 %	.0000E+00
295	.4774E+04	99.4 %	.3293E+00
296	.3380E+04	70.4 %	
297	.1390E+03	3.0 %	-.3311E+00
298	.1685E+02	.5 %	.0000E+00
299	.1274E+02	.4 %	.0000E+00
300	.9554E+01	.3 %	.0000E+00

HA ~~215~~

DRAFT

301	.6369E+01	.3 %	.0000E+00
302	.3185E+01	.2 %	.0000E+00
303	.0000E+00	.1 %	.0000E+00
304	.4774E+04	99.4 %	.3384E+00
305	.3472E+04	72.3 %	
306	.1390E+03	3.0 %	-.3403E+00
307	.1408E+02	.4 %	.0000E+00
308	.9779E+01	.3 %	.0000E+00
309	.6519E+01	.3 %	.0000E+00
310	.3260E+01	.2 %	.0000E+00
311	.0000E+00	.1 %	.0000E+00
312	.4774E+04	99.4 %	.3481E+00
313	.3570E+04	74.3 %	
314	.1390E+03	3.0 %	-.3504E+00
315	.1131E+02	.4 %	.0000E+00
316	.6769E+01	.3 %	.0000E+00
317	.3385E+01	.2 %	.0000E+00
318	.0000E+00	.1 %	.0000E+00
319	.4774E+04	99.4 %	.3588E+00
320	.3683E+04	76.7 %	
321	.1390E+03	3.0 %	-.3617E+00
322	.8538E+01	.3 %	.0000E+00
323	.3635E+01	.2 %	.0000E+00
324	.0000E+00	.1 %	.0000E+00
325	.4774E+04	99.4 %	.3723E+00
326	.3822E+04	79.6 %	
327	.1390E+03	3.0 %	-.3753E+00
328	.5769E+01	.3 %	.0000E+00
329	.0000E+00	.1 %	.0000E+00
330	.4774E+04	99.4 %	.3827E+00
331	.3978E+04	82.8 %	
332	.1390E+03	3.0 %	-.3910E+00
333	.3000E+01	.2 %	.0000E+00
334	.3000E+01	.2 %	.0000E+00
335	.0000E+00	.1 %	.0000E+00
336	.4774E+04	99.4 %	.3952E+00
337	.4150E+04	86.4 %	
338	.1390E+03	3.0 %	-.4084E+00
339	.3000E+01	.2 %	.0000E+00
340	.0000E+00	.1 %	.0000E+00

HA 216

341	.4774E+04	99.4 %	.4145E+00
342	.4334E+04	90.2 %	- .4278E+00
343	.1390E+03	3.0 %	.0000E+00
344	.3000E+01	.2 %	.0000E+00
345	.0000E+00	.1 %	.0000E+00
346	- .6502E+01	.0 %	.0000E+00
347	.4774E+04	99.4 %	.4372E+00
348	.1390E+03	3.0 %	- .4500E+00
349	.3000E+01	.2 %	.0000E+00
350	.0000E+00	.1 %	.0000E+00
351	- .3333E+01	.1 %	.0000E+00
352	.4774E+04	99.4 %	.4658E+00
353	.1390E+03	3.0 %	- .4766E+00
354	.3000E+01	.2 %	.0000E+00
355	.0000E+00	.1 %	.0000E+00
356	- .3333E+01	.1 %	.0000E+00
357	.4774E+04	99.4 %	.4991E+00
358	.1390E+03	3.0 %	- .5084E+00
359	.3000E+01	.2 %	.0000E+00
360	.0000E+00	.1 %	.0000E+00
361	- .3333E+01	.1 %	.0000E+00
362	.4774E+04	99.4 %	.5394E+00
363	.1390E+03	3.0 %	- .5487E+00
364	.3000E+01	.2 %	.0000E+00
365	.0000E+00	.1 %	.0000E+00
366	- .3333E+01	.1 %	.0000E+00
367	.4774E+04	99.4 %	.5913E+00
368	.1390E+03	3.0 %	- .6004E+00
369	.3000E+01	.2 %	.0000E+00
370	.0000E+00	.1 %	.0000E+00
371	- .3333E+01	.1 %	.0000E+00
372	.4774E+04	99.4 %	.6582E+00
373	.1390E+03	3.0 %	- .6675E+00
374	.3000E+01	.2 %	.0000E+00
375	.0000E+00	.1 %	.0000E+00
376	- .3333E+01	.1 %	.0000E+00
377	.4774E+04	99.4 %	.7590E+00
378	.1390E+03	3.0 %	- .7693E+00
379	.3000E+01	.2 %	.0000E+00
380	.0000E+00	.1 %	.0000E+00

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381	-.3333E+01	.1 %	.0000E+00
382	.4774E+04	99.4 %	.9602E+00
383	.1390E+03	3.0 %	-.9698E+00
384	.3000E+01	.2 %	.0000E+00
385	.0000E+00	.1 %	.0000E+00
386	-.3333E+01	.1 %	.0000E+00
387	.4774E+04	99.4 %	.1115E+01
388	.1390E+03	3.0 %	-.1115E+01
389	.3000E+01	.2 %	.0000E+00
390	.0000E+00	.1 %	.0000E+00
391	-.3333E+01	.1 %	.0000E+00
392	.1390E+03	3.0 %	.2966E+00
393	.1390E+03	3.0 %	-.3061E+00

FLOW (-) = 2.8063E+02 FLOW (+) = 2.8059E+02

FLOW(AVE) = 2.8061E+02

ELEMENT FLOWRATES

ELMT	V1	V2	P-AXIS ANG	RES V	DIR OF V
1	-.221E+03	-.135E+01	.000E+00	.221E+03	-.180E+03
2	-.679E-02	-.461E-02	.000E+00	.821E-02	-.146E+03
3	-.242E-02	-.436E-02	.000E+00	.499E-02	-.119E+03
4	-.219E+03	.429E+01	.000E+00	.219E+03	.179E+03
5	-.692E-02	-.134E-01	.000E+00	.151E-01	-.117E+03
6	-.258E-02	-.134E-01	.000E+00	.136E-01	-.101E+03
7	-.107E+02	.150E+02	.000E+00	.184E+02	.125E+03
8	-.458E+02	-.186E+02	.000E+00	.494E+02	-.158E+03

HA 218

9	-.896E-02	-.214E-01	.000E+00	.232E-01	-.113E+03
10	-.226E-02	-.221E-01	.000E+00	.222E-01	-.958E+02
11	.270E+01	-.414E+01	.000E+00	.494E+01	-.569E+02
12	.105E-03	-.171E-02	.000E+00	.171E-02	-.865E+02
13	-.144E-03	-.262E-01	.000E+00	.262E-01	-.903E+02
14	-.191E-03	-.253E-01	.000E+00	.253E-01	-.904E+02
15	-.700E+00	.117E+01	.000E+00	.136E+01	.121E+03
16	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	-.306E-03	-.257E-01	.000E+00	.257E-01	-.907E+02
18	-.553E-04	-.260E-01	.000E+00	.260E-01	-.901E+02
19	.186E+00	-.334E+00	.000E+00	.382E+00	-.609E+02
20	-.195E-03	-.267E-01	.000E+00	.267E-01	-.904E+02
21	-.191E-03	-.263E-01	.000E+00	.263E-01	-.904E+02
22	-.726E-04	-.263E-01	.000E+00	.263E-01	-.902E+02
23	-.503E-01	.969E-01	.000E+00	.109E+00	.117E+03
24	-.212E-03	-.270E-01	.000E+00	.270E-01	-.904E+02
25	-.727E-04	-.271E-01	.000E+00	.271E-01	-.902E+02
26	-.641E-04	-.267E-01	.000E+00	.267E-01	-.901E+02
27	.144E-01	-.296E-01	.000E+00	.329E-01	-.641E+02
28	-.241E-03	-.275E-01	.000E+00	.275E-01	-.905E+02
29	-.821E-04	-.275E-01	.000E+00	.275E-01	-.902E+02
30	-.408E-02	.883E-02	.000E+00	.973E-02	.115E+03
31	-.246E-03	-.279E-01	.000E+00	.279E-01	-.905E+02
32	-.859E-04	-.279E-01	.000E+00	.279E-01	-.902E+02
33	.870E-03	-.160E-02	.000E+00	.182E-02	-.615E+02
34	-.252E-03	-.283E-01	.000E+00	.283E-01	-.905E+02
35	-.884E-04	-.283E-01	.000E+00	.283E-01	-.902E+02
36	-.561E-03	.117E-02	.000E+00	.130E-02	.116E+03
37	-.255E-03	-.286E-01	.000E+00	.286E-01	-.905E+02
38	-.897E-04	-.285E-01	.000E+00	.285E-01	-.902E+02
39	.394E-03	-.922E-03	.000E+00	.100E-02	-.669E+02
40	-.259E-03	-.289E-01	.000E+00	.289E-01	-.905E+02
41	-.921E-04	-.289E-01	.000E+00	.289E-01	-.902E+02
42	-.986E-03	.296E-02	.000E+00	.312E-02	.108E+03
43	-.264E-03	-.295E-01	.000E+00	.295E-01	-.905E+02
44	-.951E-04	-.294E-01	.000E+00	.294E-01	-.902E+02
45	-.270E-03	-.300E-01	.000E+00	.300E-01	-.905E+02
46	-.983E-04	-.299E-01	.000E+00	.299E-01	-.902E+02
47	-.277E-03	-.305E-01	.000E+00	.305E-01	-.905E+02
48	-.104E-03	-.304E-01	.000E+00	.304E-01	-.902E+02

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49	-.274E-03	-.309E-01	.000E+00	.309E-01	-.905E+02
50	-.101E-03	-.308E-01	.000E+00	.308E-01	-.902E+02
51	-.284E-03	-.313E-01	.000E+00	.313E-01	-.905E+02
52	-.104E-03	-.312E-01	.000E+00	.312E-01	-.902E+02
53	-.340E-03	-.318E-01	.000E+00	.318E-01	-.906E+02
54	-.127E-03	-.317E-01	.000E+00	.317E-01	-.902E+02
55	-.348E-03	-.325E-01	.000E+00	.325E-01	-.906E+02
56	-.133E-03	-.323E-01	.000E+00	.323E-01	-.902E+02
57	-.362E-03	-.332E-01	.000E+00	.332E-01	-.906E+02
58	-.139E-03	-.330E-01	.000E+00	.330E-01	-.902E+02
59	-.378E-03	-.340E-01	.000E+00	.340E-01	-.906E+02
60	-.147E-03	-.338E-01	.000E+00	.338E-01	-.902E+02
61	-.396E-03	-.348E-01	.000E+00	.348E-01	-.907E+02
62	-.157E-03	-.346E-01	.000E+00	.346E-01	-.903E+02
63	-.419E-03	-.357E-01	.000E+00	.357E-01	-.907E+02
64	-.168E-03	-.355E-01	.000E+00	.355E-01	-.903E+02
65	-.442E-03	-.366E-01	.000E+00	.366E-01	-.903E+02
66	-.180E-03	-.364E-01	.000E+00	.364E-01	-.907E+02
67	-.467E-03	-.376E-01	.000E+00	.376E-01	-.907E+02
68	-.193E-03	-.374E-01	.000E+00	.374E-01	-.903E+02
69	-.495E-03	-.387E-01	.000E+00	.387E-01	-.907E+02
70	-.208E-03	-.385E-01	.000E+00	.385E-01	-.903E+02
71	-.560E-03	-.399E-01	.000E+00	.399E-01	-.908E+02
72	-.238E-03	-.397E-01	.000E+00	.397E-01	-.903E+02
73	-.677E-03	-.413E-01	.000E+00	.413E-01	-.909E+02
74	-.294E-03	-.411E-01	.000E+00	.411E-01	-.904E+02
75	-.738E-03	-.430E-01	.000E+00	.430E-01	-.910E+02
76	-.330E-03	-.427E-01	.000E+00	.427E-01	-.904E+02
77	-.803E-03	-.448E-01	.000E+00	.448E-01	-.910E+02
78	-.366E-03	-.446E-01	.000E+00	.446E-01	-.905E+02
79	-.857E-03	-.469E-01	.000E+00	.469E-01	-.910E+02
80	-.393E-03	-.466E-01	.000E+00	.466E-01	-.905E+02
81	-.971E-03	-.485E-01	.000E+00	.485E-01	-.911E+02
82	-.481E-03	-.489E-01	.000E+00	.489E-01	-.906E+02
83	-.573E-03	-.516E-01	.000E+00	.516E-01	-.906E+02
84	-.615E-03	-.548E-01	.000E+00	.548E-01	-.906E+02
85	-.749E-03	-.587E-01	.000E+00	.587E-01	-.907E+02
86	-.882E-03	-.638E-01	.000E+00	.638E-01	-.908E+02
87	-.101E-02	-.702E-01	.000E+00	.702E-01	-.908E+02
88	-.128E-02	-.788E-01	.000E+00	.788E-01	-.909E+02

HA 220

[illegible]

HA 22

DRAFT

**Dam Breach Analysis
Havana Power Station
East Ash Pond #3B**

**December 14, 2001
JHK**

The dam breach analysis was done with the use of two computer programs by Boss Corporation. The first was BREACH and the second was DAMBRK. The critical section for the dam breach analysis was taken as the northeast side of pond 3B. This portion of the dam is adjacent to a rural road with houses nearby and a manufacturing facility across the road. This section of the dam is not the highest portion, but it does represent the greatest risk of safety to life and property. The facility/houses would have a combined occupancy of 10 to 15 during a rainstorm event.

Using the BOSS BREACH computer program, possible failure of the dam via overtopping will be modeled. The polypropylene liner and one-foot clay layer are ignored in the modeling due to limitations in the program and their relative small effects during a dam failure. BREACH modeled the erosion of the dam due to a ½-PMP (i.e.; a 16" rain in 24 hours) rainstorm washing out the top of the dam, overtopping occurring and then erosion of a section of the dam. The HEC-1 analysis results giving the maximum stage elevation of approximately 494' during the ½-PMP rainstorm were used as a top of the dam input to the BREACH and DAMBRK models. The topographic plans showing that the area near the northeast corner of the dam had a minimum elevation of 467', therefore this elevation was used as the input to the BREACH and DAMBRK models for the bottom of the dam. Pond water below this elevation is ignored when computing reservoir volumes. For flows into the pond during the failure, it was assumed that overtopping would begin at hour 4 of a ½-PMP storm event. The distribution of this storm is shown on the following pages. In addition to this, a plant flow of 11.9 cfs is added.

From the soil reports, the average D_{50} value for embankment materials is 0.346 mm. The density for 95% of standard Proctor is 105.6 pcf. The ϕ angle is 30.4°, and the soil has negligible cohesion ($C=10$ psf is used as a non-zero value).

The BREACH model indicated that the dam would be protected by the vegetation for a period of time, but that failure of the dam would occur after the vegetation had eroded away. BREACH indicated a peak outflow of 14,693 cfs during the dam failure with a final breach bottom width of 9.5 feet. The side slopes of the breach were approximately 1:1.

DAMBRK was run to analyze the flood crest from the dam to the manufacturing facility and nearby houses. No analysis was done downstream of the manufacturing facility and houses since modeling the flow around the structures with DAMBRK would be very difficult, and give somewhat questionable results. Furthermore, the risk to life safety is greatest at these structures.

The closest house is approximately 200' from the top of the dam and the INTERMET-Havana Foundry manufacturing facility is approximately 650 feet from the top of the dam.

HA 088
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DRAFT

**Dam Breach Analysis
Havana Power Station
East Ash Pond #3B**

**December 14, 2001
JHK**

To run DAMBRK, several criteria had to be selected and assumptions made in order for the program to run. These are listed below:

1. A Manning's coefficient value of 0.04 for the entire downstream channel.
2. The maximum top width of the downstream channel of 200 feet.
3. A constant turbine outflow of 100 cfs was used in order to avoid computational problems with the program.
4. A constant inflow of 165 cfs into the pond. This is the sum of the maximum value of the inflow hydrograph used in BREACH plus the 100 cfs assumed for turbine flow.
5. The grade is approximately at elevation 467 along the entire channel. A fictitious channel of 10-foot width and a constant slope of 15 feet per mile was added to avoid computational problems in the program.

The key results of the DAMBRK run are summarized below:

1. Maximum outflow of 16,295 cfs. This was considered close enough to the 14,693 cfs value (~10%) calculated by BREACH to be acceptable.
2. The maximum stage of the breach wave is about 10 feet with a velocity of 9.3 ft/sec., at a distance of about 500 feet (.075 miles) from the dam.

HA 223

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Figure 4. Median time distribution derived from combining all 261 storms from the central Illinois network

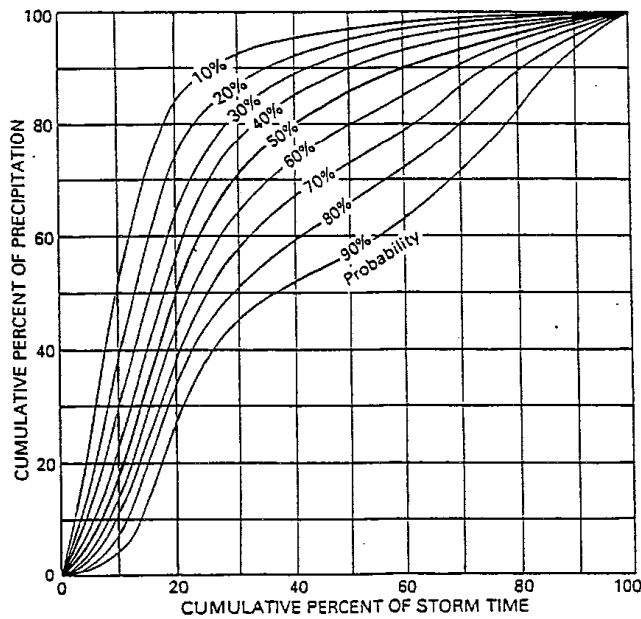
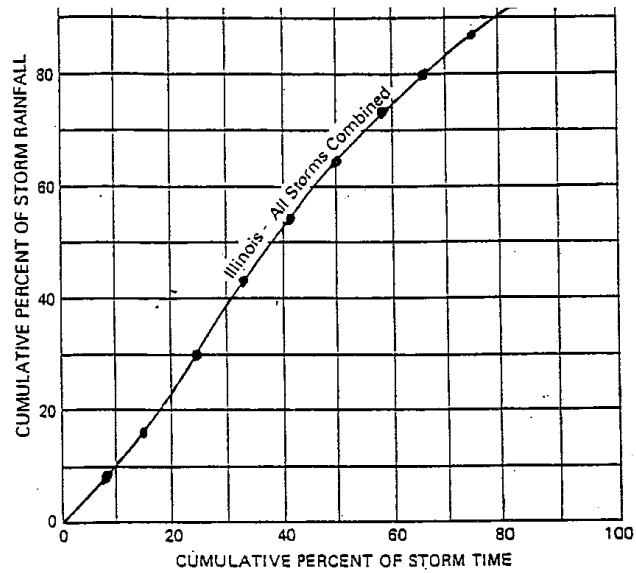


Figure 5. Time distribution of areal mean rainfall in first-quartile storms

From: Time Distributions of Heavy Rainstorms in Illinois by Floyd Huff, Illinois State Water Survey, 1990

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Flow into pond 3B from the 1/2-PMP storm by 2-hr. intervals

hour	% storm	% precipitation	delta % precip.	inches rain	avg. cfs	avg.+plant inflow
2	8.33	8	8	1.28	30.35	42.25
4	16.66	16	8	1.28	30.35	42.25
6	25.00	30	14	2.24	53.12	65.02
8	33.33	42	12	1.92	45.53	57.43
10	41.66	53	11	1.76	41.73	53.63
12	50.00	66	13	2.08	49.32	61.22
14	58.33	74	8	1.28	30.35	42.25
16	66.66	80	6	0.96	22.76	34.66
18	75.00	87	7	1.12	26.56	38.46
20	83.33	92	5	0.8	18.97	30.87
22	91.66	96	4	0.64	15.18	27.08
24	100.00	100	4	0.64	15.18	27.08

Total rainfall = 16.00

Avg. cfs = (in. rain)*2,048,802 sq. ft./[(12"/ft)(2 hrs *60 min/hr*60 sec/min)]

Plant inflow = 11.9 cfs

HA 2d5

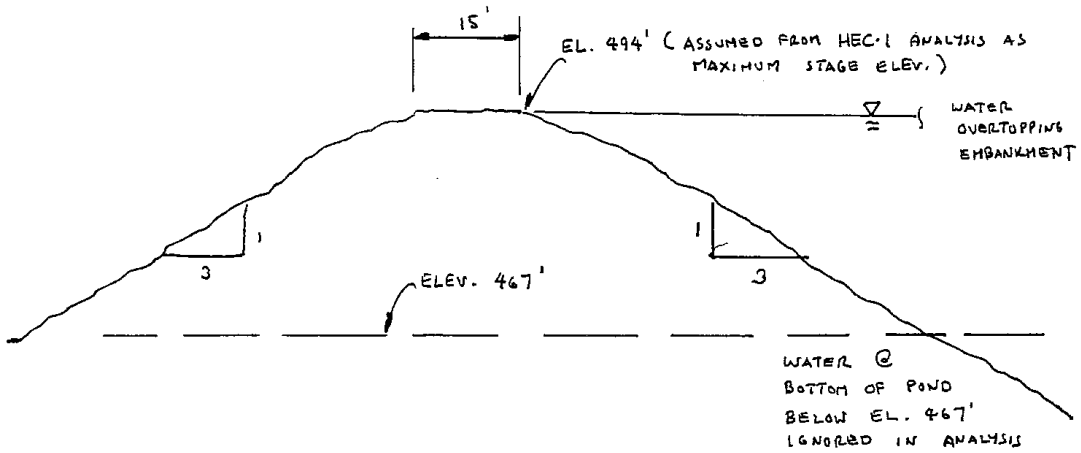
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SUBJECT:

DESIGNER:

PAGE:

DATE:



POND AREA @ EL. 467' = 1,360,766 ft²
= 31.2 acres

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

PAGE 1
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B O S S B R E A C H (tm)

=====

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Version : 1.10
Serial Number : 22205

PROGRAM ORIGIN :

Boss Breach (tm) is an enhanced version of Professor D. L. Fread's
July 1988 NWS BREACH program.

DISCLAIMER :

Boss Breach (tm) is a complex program which requires engineering expertise
to use correctly. Boss Corporation assumes absolutely no responsibility
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not exceed the purchase price of this software.

PROJECT DESCRIPTION :

PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :
DESCRIPTION : Calculate peak outflow during dam failu
ENGINEER : JHK
DATE OF RUN : 11/09/2001
TIME OF RUN : 2:51 pm

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BOSS BREACH version 1.10

PAGE 2

PROJECT TITLE : Havana East Ash Pond #3B

PROJECT NUMBER :

11/09/2001

INPUT DATA :

INFLOW HYDROGRAPH DESCRIPTION :

Time Elapsed TIN(I) (hr)	Upstream Inflow QIN(I) (cfs)
.00	42.3
2.00	42.3
4.00	65.0
6.00	57.4
8.00	53.6
10.00	61.2
12.00	42.3
14.00	34.7

RESERVOIR VOLUME DESCRIPTION :

Elevation HSA(I) (ft MSL)	Surface Area RSA(I) (acres)
494.00	45.3
467.00	31.2
.00	.0
.00	.0
.00	.0
.00	.0
.00	.0
.00	.0

TAILWATER CROSS-SECTION DESCRIPTION :

Elevation HSTW(I) (ft MSL)	Tailwater Top Width BSTW(I) (ft)	Tailwater Manning n CMTW(I)
466.90	.0	.0340
467.00	100.0	.0350
470.00	4000.0	.0350
.00	.0	.0000
.00	.0	.0000
.00	.0	.0000
.00	.0	.0000
.00	.0	.0000

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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11/09/2001

RESERVOIR AND OVERTOPPING BREACH DESCRIPTION :

Initial Reservoir Water Surface Elevation (ft MSL, HI)	494.00
Dam Bottom Elevation (ft MSL, HL)	467.00
Dam Top Elevation (ft MSL, HU)	494.00
Spillway Crest Elevation (ft MSL, HSP)	.00
Dam Crest Length (ft, CRL)	550.00
Dam Crest Width (ft, WC)	15.00
Ratio of Breach Width to Flow Depth (BR)	2.000
Initial Breach Depth on Downstream Face (ft, H)	.1000

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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11/09/2001

DAM INNER CORE DESCRIPTION :

D50 Grain Size (mm, D50C)	.000
Ratio of D90 to D30 Grain Sizes (UNFCC)	.000
Porosity Ratio (PORC)	.000
Unit Weight (lb/cu ft, UWC)	.00
Manning n of Core Material (CNC)	.0000
Internal Friction Angle (degrees, AFRC)	.00
Cohesive Strength (lb/sq ft, COHC)	.00
Average Upstream & Downstream Inner Core Slope (ZC)	1 : .00

DAM OUTER CORE DESCRIPTION :

D50 Grain Size (mm, D50S)	.346
Ratio of D90 to D30 Grain Sizes (UNFCS)	2.500
Porosity Ratio (PORS)	.360
Unit Weight (lb/cu ft, UWS)	105.00
Manning n of Core Material (CNS)	.0000
Internal Friction Angle (degrees, AFRS)	30.40
Cohesive Strength (lb/sq ft, COHS)	10.00
Average Clay Plasticity Index (PI)	.00
CA Clay Critical Shear Stress Coefficient (CA)	.020
CB Clay Critical Shear Stress Coefficient (CB)	.600

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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11/09/2001

DAM FACE DESCRIPTION :

Upstream Face Slope (ZU)	1 (vertical) :	3.00
Downstream Face Slope (ZD)	1 (vertical) :	3.00
Downstream Face D50 Grain Size (mm, D50DF)		.000
Downstream Face D90 to D30 Grain Size Ratio (UNFCDF)		.000
Average Grass Length (inches, GL)		3.00
Grass Condition Factor (1=good, 0=none, GS)		.80
Maximum Grass-Lined Channel Velocity (ft/sec, VMP)		1.50

BOUNDARY CONDITIONS :

Simulation Duration (hr, TEH)	12.00
Basic Time-Step Size (hr, DTH)	.005
Iteration Error Tolerance (% , ERR)	.01
Downstream River Bottom Slope (ft/mi, SM)	5.000
Maximum Allowable Breach Bottom Width (ft, BMX)	.000
Discharge Plot Time-Step Interval (FPT)	10.00
Time-step at which Plotting Starts (TPR)	.00

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BOSS BREACH version 1.10

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PROJECT TITLE : Havana East Ash Pond #3B

PROJECT NUMBER :

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INTERNAL COMPUTATION CHECKS :

Avg. inner & outer matl. internal friction angle (rad, AFRA)	30.40
Equation 21 Theta1' (radians, TH1)	60.20
Equation 13 Critical Depth H1' (ft, H1)	.67
Equation 21 Theta2' (radians, TH2)	45.30
Equation 13 Critical Depth H2' (ft, H2)	2.16
Equation 21 Theta3' (radians, TH3)	37.85
Equation 13 Critical Depth H3' (ft, H3)	6.95

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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FAILURE CODES (KG) :

- 0 = No erosion of grassed face
- 1 = Erosion of dam downstream face
- 2 = Erosion of dam upstream face
- 3 = Draining of reservoir with breach size continuing to increase
- 4 = Piping mode
- 5 = Collapse mode

PPP DESCRIPTION BASED ON ABOVE FAILURE CODES (KG) :

- 1 = Depth of erosion perpendicular to downstream face
- 2 = Length of breach along downstream face
- 3 = Increase in breach width
- 4 = Elevation of top of piping breach

HP DESCRIPTION BASED ON ABOVE FAILURE CODES (KG) :

- 1 = Erosion width across top of dam
- 2 = Erosion depth at upstream face
- 3 = Breach flow depth
- 4 = Piping head

BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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SUMMARY OF OUTPUT RESULTS :

GENERAL RESULTS :

Total Number of Iterations	0
Time of Breach Failure (hr, TFHI)	.01
Total Time-Steps Used (I)	2290
Total Elapsed Time (hr, T)	7.708
Outflow Hydrograph Rising Limb Duration (hr, TRS)	.029
Time at which Significant Rise in Outflow Begins (hr, TB)	5.711
Dam Top Elevation (ft MSL, HU)	494.00
Outflow at Time Zero (cfs, QO)	.0
Simplified Time of Breach Failure (hr, TFH)	.452
TFH - Time of failure (hr) which is a linear equivalent of the outflow hydrograph rising limb duration (TRS) obtained by using the simplified dam-break discharge equation.	
TFHI - Time of failure (hr) which is a linear equivalent of	

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the outflow hydrograph rising limb duration (TRS) obtained
by integrating breach outflow (QB) versus time from
T=0 to T=Peak Outflow (TP).

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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OUTPUT RESULTS AT TIME OF PEAK OUTFLOW :

Elapsed Time (hr, TP)	5.791
Spillway Outflow (cfs)	0.
Breach Outflow (cfs, QBP)	14693.
Total Outflow (cfs, QP)	14693.
Breach Top Width (ft, BRW)	79.0
Breach Bottom Width (ft, BO)	9.5
Breach Side Slope Relative to Vertical (degrees, Z)	52.15

OUTPUT RESULTS AT END OF BREACH ANALYSIS :

Breach Depth (ft, BRD)	27.0
Breach Bottom Elevation (ft MSL, HC)	467.0
Breach Side Slope Relative to Vertical (degrees, AGL)	52.15
Reservoir Water Surface Elevation (ft MSL, HY)	475.9

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BOSS BREACH version 1.10
PROJECT TITLE : Havana East Ash Pond #3B
PROJECT NUMBER :

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11/09/2001

OUTPUT HYDROGRAPH PLOT :

TIME
DISCHARGE
(hr)
(cfs)

	60.	2060.	4060.	6060.	8060.	10060.	12060.	14060.	16060.	18060.
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5.751 *	60.									
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5.851 .	14445.							*		
5.901 .	12982.							*		
5.951 .	11726.						*			
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6.151 .	8143.				*					
6.201 .	7500.			*						
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6.351 .	5967.		*							
6.401 .	5559.		*							
6.451 .	5190.		*							
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6.551 .	4555.	*								
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6.751 .	3588.	*								
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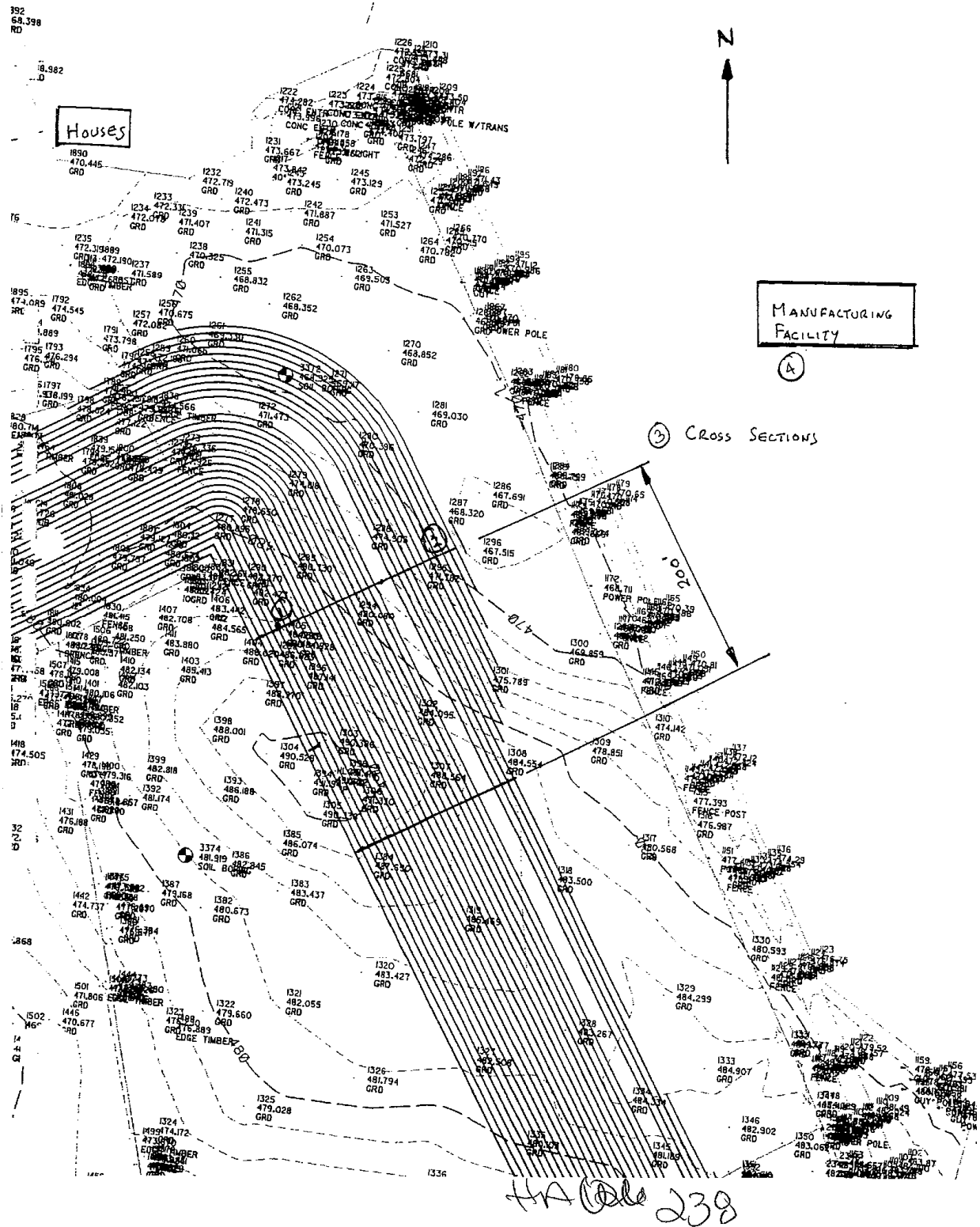
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BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B

PAGE 1
11/09/2001

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B O S S D A M B R K (tm)

=====

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Version : 3.00
Serial Number : 23619

Illinois Power Co.

PROGRAM ORIGIN :

Boss Dambrk (tm) is an enhanced version of Professor D. L. Fread's
1991 NWS DAMBRK program.

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arising out of purchase or use of this software. The sole and exclusive
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not exceed the purchase price of this software.

PROJECT DESCRIPTION :

PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B
DESCRIPTION : South East side dam break analysis
ENGINEER : John Kao
DATE OF RUN : 11/09/2001
TIME OF RUN : 4:04 pm

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BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B

PAGE 2
11/09/2001

INPUT DATA SUMMARY :

INPUT CONTROL PARAMETERS :

Problem Specification Option	13
Number of Dynamic Routing Reaches (KKN)	1
Type of Reservoir Routing (KUI)	1 (dynamic routing)
Number of multiple dams/bridges (MULDAM)	1
No. of Reservoir Inflow Hydrograph Points (ITEH)	2
No. of Informational Cross-Sections (NPRT)	3
Flood-Plain Routing (KFLP)	0 (no)

SEQUENTIAL CROSS-SECTION NUMBERS (NPT) :

2 . 3 4

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BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B

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CROSS-SECTION NUMBERS COINCIDENT
WITH UPSTREAM DAM FACE (IDAM) :

1

RESERVOIR VOLUME DESCRIPTION :

Elevation vs. Surface Area Table

Elevation Surface	
Area	
HSA(K)	SA(K)
(ft MSL)	(acres)
494.00	45.300
492.00	44.280
467.00	31.240
466.90	0.000
0.00	0.000
0.00	0.000
0.00	0.000
0.00	0.000

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BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B

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11/09/2001

DAM NUMBER : 1

RESERVOIR AND BREACH PARAMETERS :

Initial Elevation of Water Surface (YO, ft MSL)	494.00
Breach Side Slope (Z)	1: 1.00
Breach Bottom Elevation (YBMIN, ft MSL)	467.00
Breach Base Width (BB, ft)	9.50
Time of Breach Formation (TFH, hr)	0.05

RESERVOIR DESCRIPTION :

Water Surface Elevation at Time of Breach (HF, ft MSL)	494.00
Top of Dam Crest Elevation (HD, ft MSL)	494.00
Uncontrolled Spillway Crest Elevation (HSP, ft MSL)	0.00
Spillway Gate Center Elevation (HGT, ft MSL)	0.00
Uncontrolled Spillway Discharge Coefficient (CS)	0.00
Spillway Gate Discharge Coefficient (CG)	0.00
Dam Overtopping Discharge Coefficient (CDO)	1320.00
Turbine Discharge (QT, cfs)	100.00

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BOSS DAMBRK version 3.00
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BOUNDARY CONDITIONS :

Hydrograph Time Intervals (DHF, hr)	0.00
Routing Period (TEH, hr)	2.00
Breach Development Exponent (BRES)	0.00
Mud/Debris Flow Parameter (MUD)	0
Dry Bed Routing Parameter (IWF)	0
Hydraulic Radius Computation Parameter (KPRES)	0 (R=A/B)
Landslide Simulation (KSL)	0 (none)
Critical Flow Froude Number (DFR)	0.950

INFLOW HYDROGRAPH DESCRIPTION :

Time Elapsed TI (K) (hr)	Upstream Inflow QI (K) (cfs)
0.00	165.0
2.00	165.0

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SUMMARY OF PROGRAM CONTROL PARAMETERS :

Problem Specification Option (KKN, KUI, MUL DAM, IDAM)	13
Number of Cross-Sections Entered (NS)	4
Number of Top Widths Entered (NCS)	8
Number of Cross-Sectional Hydrographs to Plot (NTT)	0
Flow Type Parameter (KSUPC)	3 (mixed flow)
Number of Lateral Inflow Hydrographs (LQ)	0
Number of Points in Gate Control Curve (KCG)	0

CHANNEL-VALLEY BOUNDARY CONDITIONS :

Max Discharge at Downstream End (QMAXD, cfs)	0.0
Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)	0.0000
Initial Time-Step Size (DTHM, hr)	-1.0000
Time at which Dam Starts to Fail (TFI, hr)	0.0000
Theta Weighting Factor (FLI)	0.000
Stage Convergence Criterion (EPSY, ft)	0.050
Downstream Boundary Type Paramter (YDN)	0.00
Slope of Channel Downstream of Dam (SOM, ft/mi)	0.0000

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CROSS-SECTION NUMBER : 1

Cross-Section Location (XS(I), mi) 1.000
Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 1

Reach Contraction-Expansion Coefficient (FKC) 0.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.000

CROSS-SECTION and REACH DESCRIPTION :

Elevation	Channel	Channel	Storage
	Top	Manning	Top
	Width	n	Width
HS(K,I)	BS(K,I)	CM(K,I)	BSS(K,I)
(ft MSL)	(ft)		(ft)
467.00	10.0	0.0400	0.0
472.00	20.0	0.0400	0.0
477.00	30.0	0.0400	0.0
482.00	40.0	0.0400	0.0
487.00	50.0	0.0400	0.0
488.00	52.0	0.0400	0.0
490.00	52.0	0.0400	0.0
495.00	52.0	0.0400	0.0

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CROSS-SECTION NUMBER : 2

Cross-Section Location (XS(I), mi) 1.038

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 2

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.001

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
466.43	10.0	0.0400	0.0
466.99	10.0	0.0400	0.0
467.00	200.0	0.0400	0.0
482.00	200.0	0.0400	0.0
487.00	200.0	0.0400	0.0
492.00	200.0	0.0400	0.0
496.00	200.0	0.0400	0.0
498.00	200.0	0.0400	0.0

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CROSS-SECTION NUMBER : 3

Cross-Section Location (XS(I), mi) 1.070
Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 3

Reach Contraction-Expansion Coefficient (FKC) 0.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.001

CROSS-SECTION and REACH DESCRIPTION :

Elevation	Channel	Channel	Storage
	Top	Manning	Top
	Width	n	Width
HS(K,I)	BS(K,I)	CM(K,I)	BSS(K,I)
(ft MSL)	(ft)		(ft)
465.95	10.0	0.0400	0.0
466.99	10.0	0.0400	0.0
467.00	140.0	0.0400	0.0
472.00	200.0	0.0400	0.0
487.00	200.0	0.0400	0.0
492.00	200.0	0.0400	0.0
496.00	200.0	0.0400	0.0
498.00	200.0	0.0400	0.0

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CROSS-SECTION NUMBER : 4

Cross-Section Location (XS(I), mi) 1.099
Flooding Elevation (FSTG(I), ft MSL) 0.000

CROSS-SECTION DESCRIPTION :

Elevation	Channel	Storage
Top	Top	Top
Width	Width	Width
HS(K,I)	BS(K,I)	BSS(K,I)
(ft MSL)	(ft)	(ft)
465.52	10.0	0.0
466.99	10.0	0.0
467.00	90.0	0.0
472.00	200.0	0.0
477.00	200.0	0.0
487.00	200.0	0.0
492.00	200.0	0.0
498.00	200.0	0.0

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DISTANCE BETWEEN INTERPOLATED CROSS-SECTIONS
(DXM) THAT WILL BE USED IN COMPUTATIONS :

Down	Interp.
Stream	Cross
Reach	Section
Number	Distance
I=1, NS1	DXM(I)
	(mi)
1	101.0000
2	0.0010
3	0.0010

Total number of cross-sections (original+interpolated)	63
Maximum number of cross-sections allowed	300

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OUTPUT DATA SUMMARY :

CROSS-SECTION and REACH SUMMARY :

Cross Section Number	Cross Section Location (mi)	Bottom Elevation (ft MSL)	Reach Number	Reach Length (mi)	Reach Slope (ft/mi)
1	1.000	467.000			
2	1.038	466.430	1	0.038	15.000
3	1.070	465.950	2	0.032	14.999
4	1.099	465.520	3	0.029	14.828

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RE-NUMBERED DAM/BRIDGE CROSS-SECTIONS :

Dam/ Bridge	Revised Cross Section Number
1	1

Number of Intermediate Cross-Sections (NN(NS))	63
Number of Time Steps (NNU)	2

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INITIAL CONDITIONS TABLE :

Cross Section Number	Cross Section Location	Normal Flow Water Elevation YN (ft MSL)	Normal Flow Depth DEPN (ft)	Critical Flow Water Elevation YC (ft MSL)	Critical Flow Depth DEPC (ft)	Froude Indicator (0 = sub) (1 = sup) IFR	Iteration Count for Computing Nrml Dpth ITN	Iteration Count for Computing Crtl Dpth ITC
I	XI (mi)							
1	1.000	469.29	2.29	468.39	1.39	0	12	12
2	1.038	467.41	0.98	467.17	0.74	0	12	12
3	1.039	467.41	0.99	467.17	0.75	0	12	12
4	1.040	467.41	1.01	467.17	0.77	0	12	12
5	1.041	467.41	1.02	467.17	0.78	0	12	12
6	1.042	467.41	1.04	467.17	0.80	0	12	12
7	1.043	467.41	1.05	467.16	0.81	0	12	12
8	1.044	467.41	1.07	467.16	0.82	0	12	12
9	1.045	467.41	1.09	467.16	0.84	0	12	12
10	1.046	467.41	1.10	467.16	0.85	0	12	12
11	1.047	467.42	1.13	467.17	0.87	0	12	12
12	1.048	467.42	1.14	467.17	0.89	0	12	12
13	1.049	467.42	1.16	467.17	0.90	0	12	12
14	1.050	467.42	1.17	467.17	0.92	0	12	12
15	1.051	467.43	1.19	467.17	0.93	0	12	12
16	1.052	467.43	1.21	467.17	0.95	0	12	12
17	1.053	467.43	1.22	467.17	0.97	0	12	12
18	1.054	467.43	1.24	467.16	0.97	0	12	12
19	1.055	467.43	1.25	467.17	0.99	0	12	12
20	1.056	467.43	1.27	467.17	1.01	0	12	12
21	1.057	467.43	1.29	467.17	1.02	0	12	12
22	1.058	467.43	1.30	467.17	1.04	0	12	12
23	1.059	467.44	1.33	467.17	1.05	0	12	12
24	1.060	467.44	1.34	467.17	1.07	0	12	12
25	1.061	467.44	1.36	467.17	1.09	0	12	12
26	1.062	467.45	1.38	467.17	1.10	0	12	12
27	1.063	467.45	1.39	467.17	1.11	0	12	12
28	1.064	467.45	1.41	467.17	1.13	0	12	12
29	1.065	467.45	1.42	467.17	1.14	0	12	12
30	1.066	467.45	1.44	467.17	1.16	0	12	12
31	1.067	467.45	1.46	467.17	1.18	0	12	12
32	1.068	467.45	1.47	467.17	1.19	0	12	12
33	1.069	467.46	1.50	467.17	1.21	0	12	12
34	1.070	467.46	1.51	467.17	1.22	0	12	12
35	1.071	467.47	1.53	467.17	1.23	0	12	12
36	1.072	467.47	1.55	467.17	1.25	0	12	12
37	1.073	467.47	1.56	467.17	1.27	0	12	12
38	1.074	467.47	1.58	467.17	1.28	0	12	12
39	1.075	467.47	1.60	467.17	1.30	0	12	12
40	1.076	467.47	1.61	467.18	1.31	0	12	12
41	1.077	467.48	1.63	467.17	1.32	0	12	12
42	1.078	467.48	1.65	467.17	1.34	0	12	12
43	1.079	467.49	1.67	467.17	1.36	0	12	12
44	1.080	467.49	1.69	467.17	1.37	0	12	12
45	1.081	467.49	1.70	467.18	1.39	0	12	12
46	1.082	467.49	1.72	467.17	1.40	0	12	12
47	1.083	467.49	1.74	467.17	1.41	0	12	12
48	1.084	467.49	1.75	467.17	1.43	0	12	12
49	1.085	467.50	1.77	467.17	1.45	0	12	12

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Cross Section Number	Cross Section Location	Normal Flow Water Elevation	Normal Flow Depth	Critical Flow Water Elevation	Critical Flow Depth	Froude Indicator (0 = sub) (1 = sup)	Iteration Count for Computing	Iteration Count for Computing
I	XI (mi)	YN (ft MSL)	DEPN (ft)	YC (ft MSL)	DEPC (ft)	IFR	ITN	ITC
50	1.086	467.50	1.79	467.17	1.46	0	12	12
51	1.087	467.50	1.80	467.17	1.47	0	12	12
52	1.088	467.51	1.83	467.17	1.49	0	12	12
53	1.089	467.51	1.84	467.17	1.50	0	12	12
54	1.090	467.51	1.86	467.17	1.52	0	12	12
55	1.091	467.52	1.88	467.18	1.54	0	12	12
56	1.092	467.52	1.89	467.17	1.55	0	12	12
57	1.093	467.52	1.91	467.17	1.56	0	12	12
58	1.094	467.52	1.93	467.17	1.58	0	12	12
59	1.095	467.52	1.94	467.17	1.59	0	12	12
60	1.096	467.53	1.97	467.17	1.60	0	12	12
61	1.097	467.53	1.98	467.17	1.62	0	12	12
62	1.098	467.54	2.00	467.17	1.64	0	12	12
63	1.099	467.54	2.02	467.17	1.65	0	12	12

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SUMMARY OF INITIAL DOWNSTREAM BOUNDARY CONDITIONS :

Cross-section Number at Downstream End of Model (IN) 63
Initial Water Surface Elev. at Downstream End (YNN, ft MSL) 467.538
Initial Flow Depth at Downstream End (DEP, ft) 2.018

COMPUTED STEP BACKWATER TABLE :

Cross Section Number	Cross Section Location	Flow QIL (cfs)	Backwater Water Surface Elevation YIL (ft MSL)	Backwater Water Depth DEP (ft)	Iteration Count for Computing Backwater ITB
62	1.098	100.0	467.555	2.020	5
61	1.097	100.0	467.570	2.021	5
60	1.096	100.0	467.584	2.020	5
59	1.095	100.0	467.597	2.018	5
58	1.094	100.0	467.609	2.015	5
57	1.093	100.0	467.620	2.011	5
56	1.092	100.0	467.630	2.006	5
55	1.091	100.0	467.640	2.001	5
54	1.090	100.0	467.649	1.995	5
53	1.089	100.0	467.657	1.989	5
52	1.088	100.0	467.665	1.982	5
51	1.087	100.0	467.673	1.975	5

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Cross Section Number	Cross Section Location	Flow QIL (cfs)	Backwater Water Surface Elevation YIL (ft MSL)	Backwater Water Depth DEP (ft)	Iteration Count for Computing Backwater ITB
I	X (mi)				
50	1.086	100.0	467.680	1.967	5
49	1.085	100.0	467.687	1.959	5
48	1.084	100.0	467.693	1.951	5
47	1.083	100.0	467.700	1.942	5
46	1.082	100.0	467.706	1.934	5
45	1.081	100.0	467.711	1.924	5
44	1.080	100.0	467.717	1.915	5
43	1.079	100.0	467.722	1.906	5
42	1.078	100.0	467.727	1.896	5
41	1.077	100.0	467.732	1.886	5
40	1.076	100.0	467.737	1.876	5
39	1.075	100.0	467.741	1.865	5
38	1.074	100.0	467.746	1.855	5
37	1.073	100.0	467.750	1.844	5
36	1.072	100.0	467.754	1.833	5
35	1.071	100.0	467.758	1.823	5
34	1.070	100.0	467.762	1.811	5
33	1.069	100.0	467.765	1.800	5
32	1.068	100.0	467.769	1.789	5
31	1.067	100.0	467.772	1.777	5
30	1.066	100.0	467.775	1.766	5
29	1.065	100.0	467.779	1.754	5
28	1.064	100.0	467.782	1.742	5
27	1.063	100.0	467.785	1.730	5
26	1.062	100.0	467.788	1.718	5
25	1.061	100.0	467.791	1.706	5
24	1.060	100.0	467.794	1.694	5
23	1.059	100.0	467.796	1.681	5
22	1.058	100.0	467.799	1.669	5
21	1.057	100.0	467.801	1.656	5
20	1.056	100.0	467.804	1.644	5
19	1.055	100.0	467.806	1.631	5
18	1.054	100.0	467.809	1.619	5
17	1.053	100.0	467.811	1.606	5
16	1.052	100.0	467.813	1.593	5
15	1.051	100.0	467.816	1.581	5
14	1.050	100.0	467.818	1.568	5
13	1.049	100.0	467.820	1.555	5
12	1.048	100.0	467.822	1.542	5
11	1.047	100.0	467.824	1.529	5
10	1.046	100.0	467.826	1.516	5
9	1.045	100.0	467.828	1.503	5
8	1.044	100.0	467.830	1.490	5
7	1.043	100.0	467.831	1.476	5
6	1.042	100.0	467.833	1.463	5
5	1.041	100.0	467.835	1.450	5
4	1.040	100.0	467.837	1.437	5
3	1.039	100.0	467.838	1.423	5
2	1.038	100.0	467.840	1.410	5
1	1.000	100.0	494.000	27.000	0

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INITIAL CONDITIONS :

Interp. Cross- Section I	Initial Water Elevation YI(I) (ft MSL)	Initial Flow QDI(I) (cfs)
1	494.00	100.0
2	467.84	100.0
3	467.84	100.0
4	467.84	100.0
5	467.83	100.0
6	467.83	100.0
7	467.83	100.0
8	467.83	100.0
9	467.83	100.0
10	467.83	100.0
11	467.82	100.0
12	467.82	100.0
13	467.82	100.0
14	467.82	100.0
15	467.82	100.0
16	467.81	100.0
17	467.81	100.0
18	467.81	100.0
19	467.81	100.0
20	467.80	100.0
21	467.80	100.0
22	467.80	100.0
23	467.80	100.0
24	467.79	100.0
25	467.79	100.0
26	467.79	100.0
27	467.78	100.0
28	467.78	100.0
29	467.78	100.0
30	467.78	100.0
31	467.77	100.0
32	467.77	100.0
33	467.77	100.0
34	467.76	100.0
35	467.76	100.0
36	467.75	100.0
37	467.75	100.0
38	467.75	100.0
39	467.74	100.0
40	467.74	100.0
41	467.73	100.0
42	467.73	100.0
43	467.72	100.0
44	467.72	100.0
45	467.71	100.0
46	467.71	100.0

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INITIAL CONDITIONS :

Interp. Cross- Section I	Initial Water Elevation YI(I) (ft MSL)	Initial Flow QDI(I) (cfs)
47	467.70	100.0
48	467.69	100.0
49	467.69	100.0
50	467.68	100.0
51	467.67	100.0
52	467.67	100.0
53	467.66	100.0
54	467.65	100.0
55	467.64	100.0
56	467.63	100.0
57	467.62	100.0
58	467.61	100.0
59	467.60	100.0
60	467.58	100.0
61	467.57	100.0
62	467.55	100.0
63	467.54	100.0

ROUTING COMPLETED :

Number of Time Steps Used (KTIME)	177
Maximum Number of Time Steps Allowed	1199
Total Time of Flood Routing (TT, hr)	2.0
Flood Wave Arrival Time based upon a WSEL Increase of (ft)	1.00

CONSERVATION OF MASS RESULTS :

Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00

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FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
1.000	494.00	16295	0.005	17.30	0.00	0.00	0.00
1.038	477.62	16295	0.080	8.90	0.00	0.00	0.02
1.039	477.60	16206	0.080	8.94	0.00	0.00	0.02
1.040	477.58	16216	0.080	8.97	0.00	0.00	0.02
1.041	477.56	16224	0.080	9.01	0.00	0.00	0.02
1.042	477.54	16230	0.080	9.04	0.00	0.00	0.02
1.043	477.52	16234	0.080	9.08	0.00	0.00	0.02
1.044	477.50	16235	0.080	9.11	0.00	0.00	0.02
1.045	477.47	16234	0.080	9.15	0.00	0.00	0.02
1.046	477.45	16231	0.080	9.18	0.00	0.00	0.03
1.047	477.43	16226	0.080	9.21	0.00	0.00	0.03
1.048	477.41	16218	0.080	9.25	0.00	0.00	0.03
1.049	477.39	16209	0.080	9.28	0.00	0.00	0.03
1.050	477.37	16198	0.080	9.31	0.00	0.00	0.03
1.051	477.35	16184	0.080	9.34	0.00	0.00	0.03
1.052	477.32	16169	0.080	9.36	0.00	0.00	0.03
1.053	477.30	16151	0.080	9.39	0.00	0.00	0.03
1.054	477.28	16131	0.080	9.40	0.00	0.00	0.03
1.055	477.26	16109	0.080	9.42	0.00	0.00	0.03
1.056	477.24	16086	0.080	9.43	0.00	0.00	0.03
1.057	477.22	16060	0.080	9.43	0.00	0.00	0.03
1.058	477.21	16032	0.080	9.43	0.00	0.00	0.03
1.059	477.19	16003	0.080	9.41	0.00	0.00	0.03
1.060	477.17	15973	0.080	9.41	0.00	0.00	0.03
1.061	477.15	15942	0.080	9.41	0.00	0.00	0.03
1.062	477.13	15910	0.080	9.40	0.00	0.00	0.03
1.063	477.11	15878	0.080	9.39	0.00	0.00	0.03
1.064	477.10	15845	0.080	9.38	0.00	0.00	0.03
1.065	477.08	15811	0.080	9.36	0.00	0.00	0.03
1.066	477.07	15776	0.080	9.33	0.00	0.00	0.03
1.067	477.05	15740	0.080	9.30	0.00	0.00	0.03
1.068	477.04	15703	0.080	9.27	0.00	0.00	0.03
1.069	477.02	15664	0.080	9.23	0.00	0.00	0.03
1.070	477.01	15625	0.075	9.18	0.00	0.00	0.03
1.071	476.99	15586	0.075	9.21	0.00	0.00	0.03
1.072	476.97	15546	0.075	9.24	0.00	0.00	0.03
1.073	476.95	15505	0.075	9.26	0.00	0.00	0.03
1.074	476.93	15463	0.075	9.29	0.00	0.00	0.03
1.075	476.90	15420	0.075	9.32	0.00	0.00	0.03
1.076	476.88	15377	0.075	9.35	0.00	0.00	0.03
1.077	476.85	15368	0.075	9.38	0.00	0.00	0.03
1.078	476.83	15368	0.075	9.42	0.00	0.00	0.03
1.079	476.80	15368	0.075	9.45	0.00	0.00	0.03
1.080	476.77	15368	0.075	9.49	0.00	0.00	0.03
1.081	476.74	15369	0.075	9.53	0.00	0.00	0.03
1.082	476.71	15369	0.075	9.57	0.00	0.00	0.03
1.083	476.68	15369	0.075	9.61	0.00	0.00	0.03
1.084	476.65	15369	0.090	9.65	0.00	0.00	0.03

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BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B

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FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
1.085	476.61	15369	0.090	9.70	0.00	0.00	0.03
1.086	476.59	15369	0.085	9.75	0.00	0.00	0.03
1.087	476.56	15369	0.085	9.81	0.00	0.00	0.03
1.088	476.53	15368	0.085	9.87	0.00	0.00	0.03
1.089	476.50	15366	0.085	9.93	0.00	0.00	0.03
1.090	476.47	15365	0.085	10.00	0.00	0.00	0.03
1.091	476.44	15362	0.085	10.07	0.00	0.00	0.03
1.092	476.41	15358	0.085	10.16	0.00	0.00	0.03
1.093	476.37	15354	0.085	10.25	0.00	0.00	0.03
1.094	476.34	15348	0.085	10.36	0.00	0.00	0.03
1.095	476.30	15340	0.085	10.47	0.00	0.00	0.03
1.096	476.25	15330	0.085	10.60	0.00	0.00	0.03
1.097	476.20	15340	0.085	10.75	0.00	0.00	0.03
1.098	476.15	15353	0.085	10.93	0.00	0.00	0.03
1.099	476.09	15363	0.085	11.16	0.00	0.00	0.03

END OF OUTPUT

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DRAFT

**Slope Stability Analysis
Havana Power Station
East Ash Pond #3B**

**September 10, 2001
JHK**

Slope stability calculations were done with the computer Slope/W produced by Geo-Slope International. The Spencer method of analysis was used.

Because the embankment will be made of highly permeable, sandy soil, and the pond will have an impermeable liner, there will not be any cases where the undrained strength of the sand will control. For all significant load conditions, the embankment will be in the consolidated-drained condition. As shown in other portions of these calculations, any seepage that would get through the liner system would migrate nearly straight down through the embankment until reaching the water table.

Based on these characteristics of the embankment, no rapid drawdown or partial pool analysis was done. The embankment was analyzed for water to the normal operating elevation of 492 feet and ash fill to 492 feet. For each of these, both seismic and non-seismic conditions were analyzed for both low and high water table. This resulted in eight separate cases being analyzed. These are summarized in the table below along with the minimum factor of safety for each case as computed by Slope/W.

Because the clay liner will be only one-foot thick, it was ignored during slope stability calculations. Its primary purpose is seepage control, not strength. For water-filled pond conditions, the clay liner was given no strength. For the ash-filled pond conditions, the clay was given the same strength properties as the ash to simplify data input. Both of these assumptions are on the conservative side. The actual weight of the clay was used on all cases.

The properties for deposited fly ash are typical values for this type of material. The properties for all other soils are from soil tests performed specifically for this project. See the Soil Reports section of these calculations for further information.

The embankment will be made of the on-site sandy soil compacted to 95% of standard Proctor density. The top ten feet of existing material is somewhat loose with a density of a little less than 95% standard Proctor density. During construction, it is likely that this material will consolidate some, but this was ignored when estimating soil properties for the upper foundation layer. The same soil properties were used for the embankment as the upper foundation layer, which is conservative. Compaction to 95% standard Proctor density will actually give slightly better strength. The deeper foundation soils are somewhat denser than 95% standard Proctor density. The properties used for the deeper foundation soils are shown on the lab reports.

The project is in earthquake zone 1. A seismic factor of 0.025 was applied to determine earthquake forces.

HA 1208
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DRAFT

**Slope Stability Analysis
Havana Power Station
East Ash Pond #3B**

**September 10, 2001
JHK**

In all cases without earthquake forces, the factor of safety was greater than 1.5. In all cases with earthquake forces, the factor of safety was greater than 1.0. Therefore, it was concluded that the embankment has adequate strength. It should also be noted, that in all the cases the minimum factor of safety was associated with slips on the downstream face of the embankment that did not penetrate to the upstream face. The graphical output shows the slip surface associated with the minimum factor of safety.

The full printout for a Slope/W run is quite large. To avoid printing a lot needless pages in this report, only sample pages are included. Full program output can be provided if needed. The following sheets contain summary information for the slope stability analysis. The content of these pages is as follows:

1. Table of analyzed conditions and corresponding factor of safety.
2. Summary of soil properties
3. Summary of ground water elevations.
4. Sketch of embankment geometry
5. Graphical computer summary of each load case.
6. First and last page from a typical analysis printout.

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DRAFT

Slope Stability Analysis
Havana Power Station
East Ash Pond #3B

September 10, 2001
JHK

Summary of Analysis Conditions

Analysis Case

	1A	1B	2A	2B	3A	3B	4A	4B
Factor of Safety	1.56	1.57	1.62	1.50	1.61	1.52	1.61	1.48
Water-filled pond	X	X	X	X				
Ash-filled pond					X	X	X	X
No seismic factor	X		X		X		X	
Seismic factor applied		X		X		X		X
High ground water elevation	X	X			X	X		
Low ground water elevation			X	X			X	X

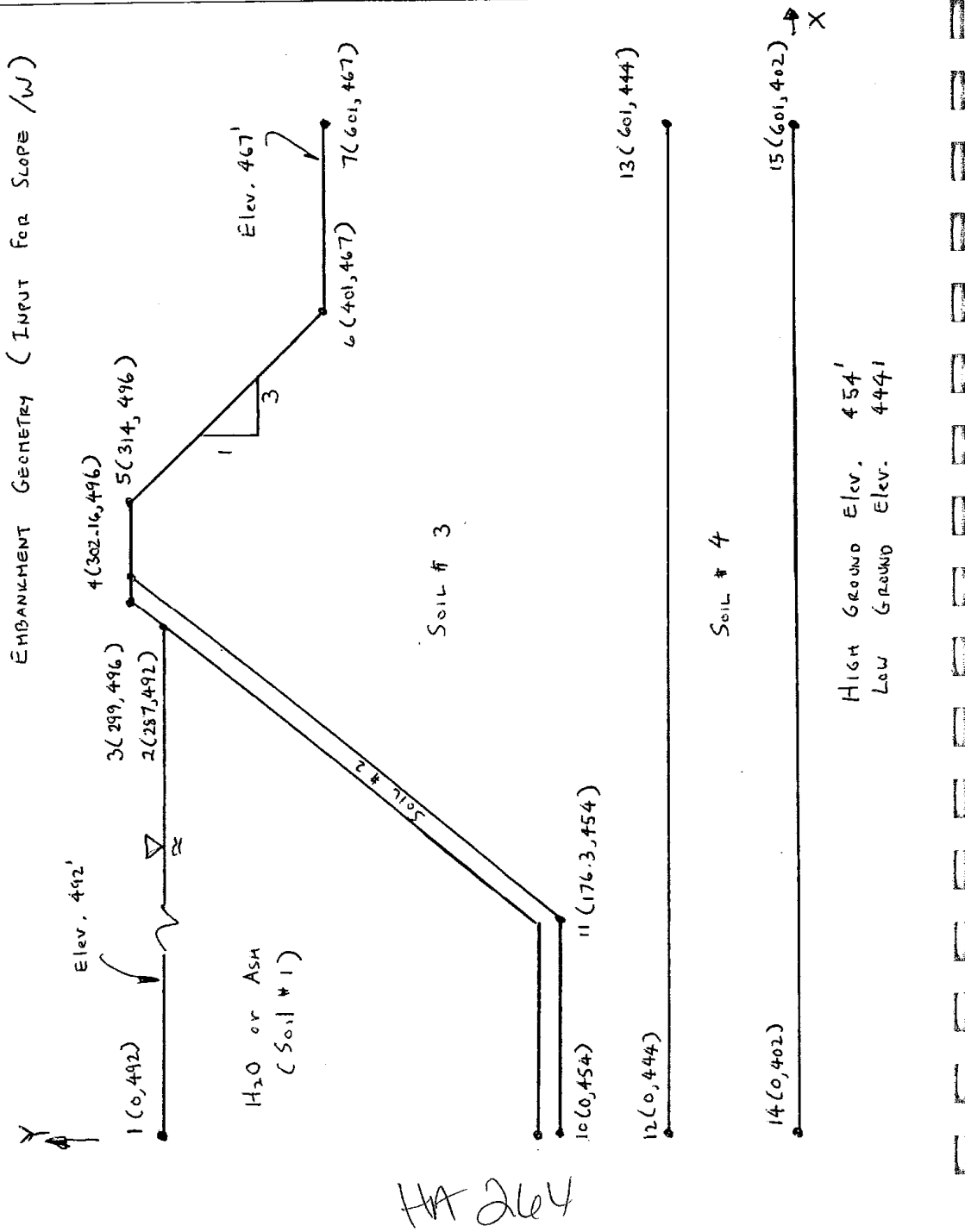
Soil Properties;

Deep Foundation Soils	Density	118.7 pcf
	Phi Angle	34 degrees
	Cohesion	0.0
Shallow Foundation Soils And Embankment	Density	103.7 pcf
	Phi Angle	26 degrees
	Cohesion	0.0
Clay Liner	Density	118.7 pcf
	Phi Angle	N/A
	Cohesion	N/A
Ash	Density	90 pcf (saturated weight)
	Phi Angle	20 degrees
	Cohesion	0.0

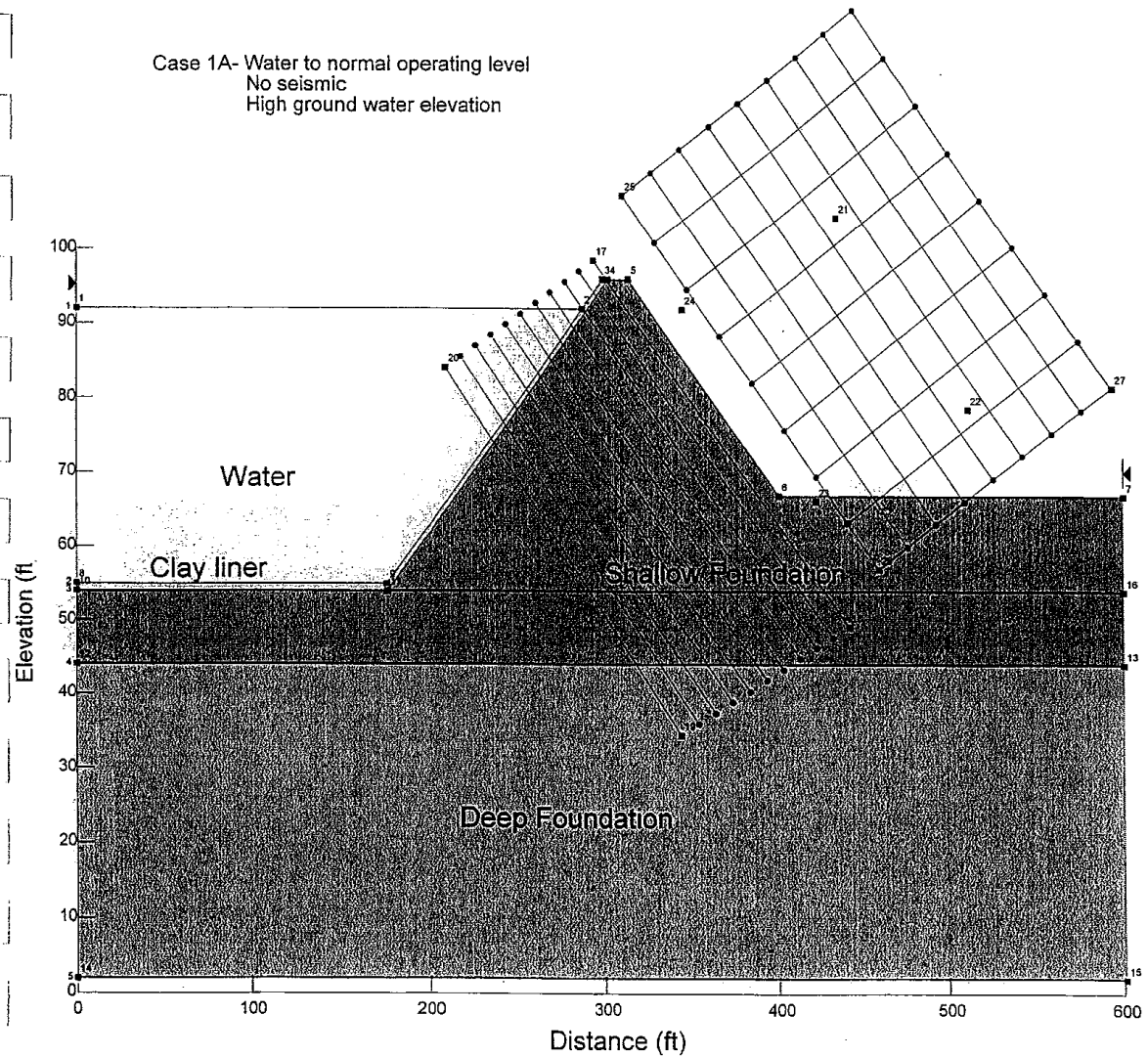
HAB 12/9
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DRAFT

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SUBJECT:	DESIGNER:
	PAGE:
	DATE:

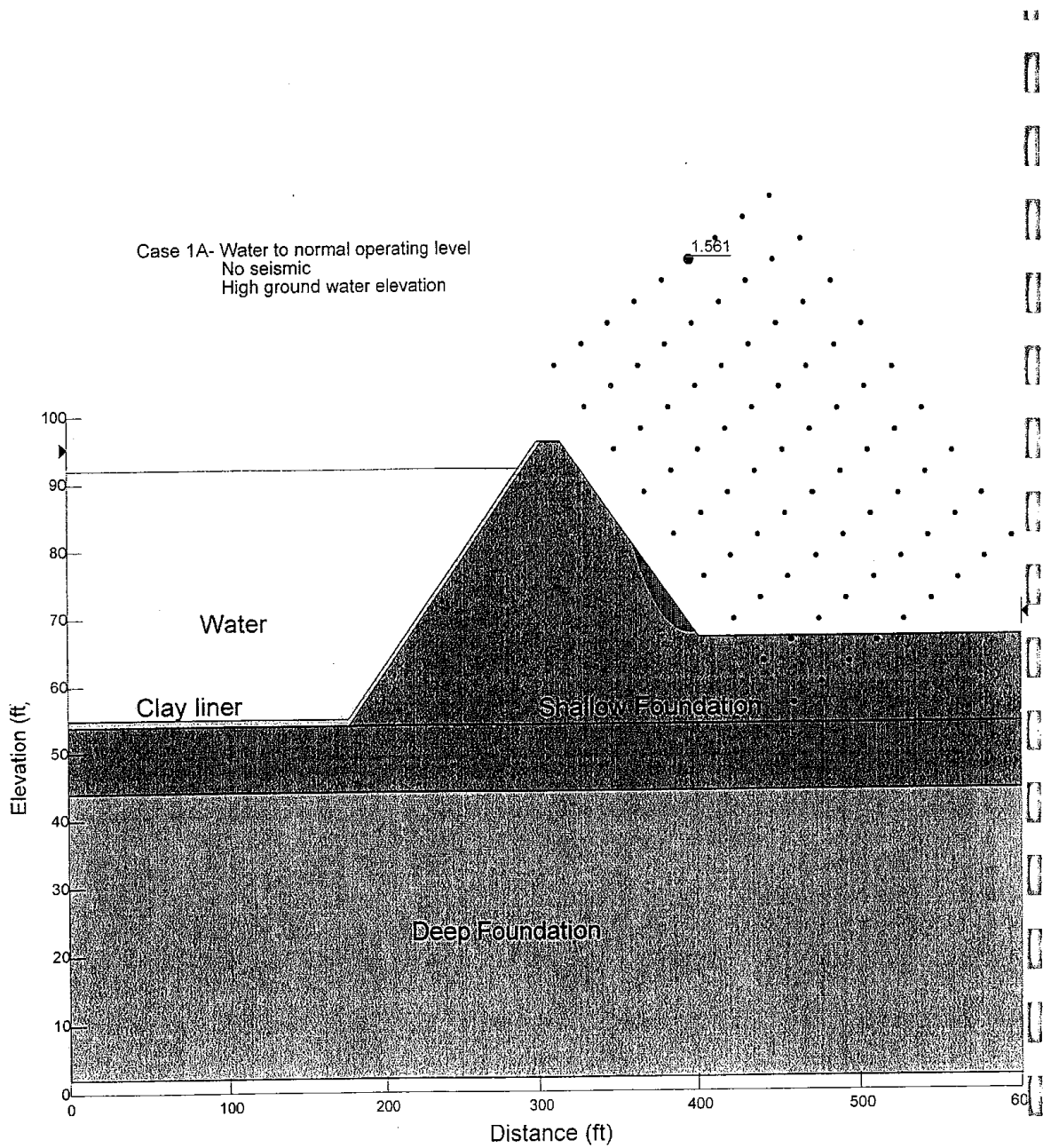


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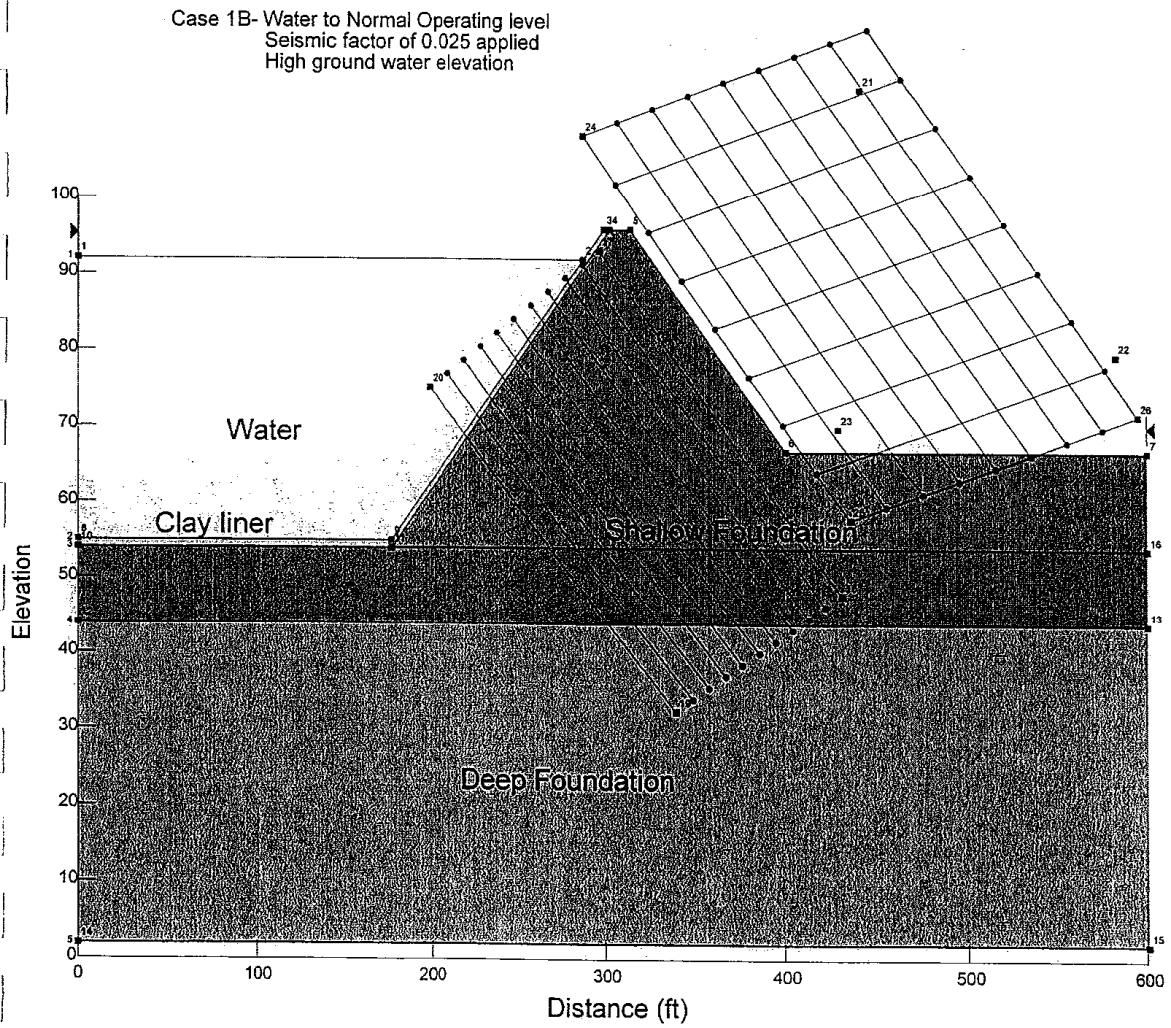
HA W/D
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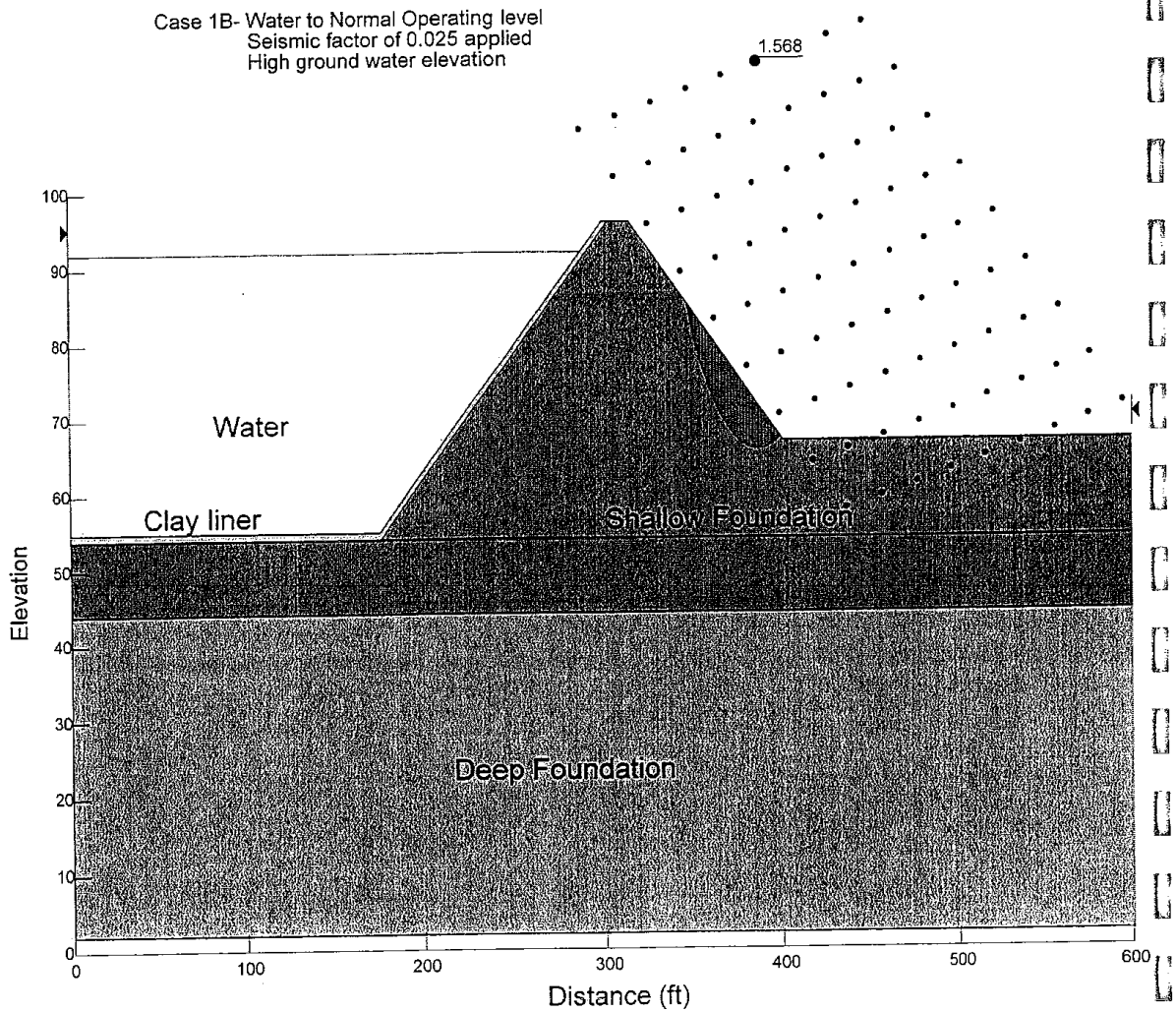
HA 266

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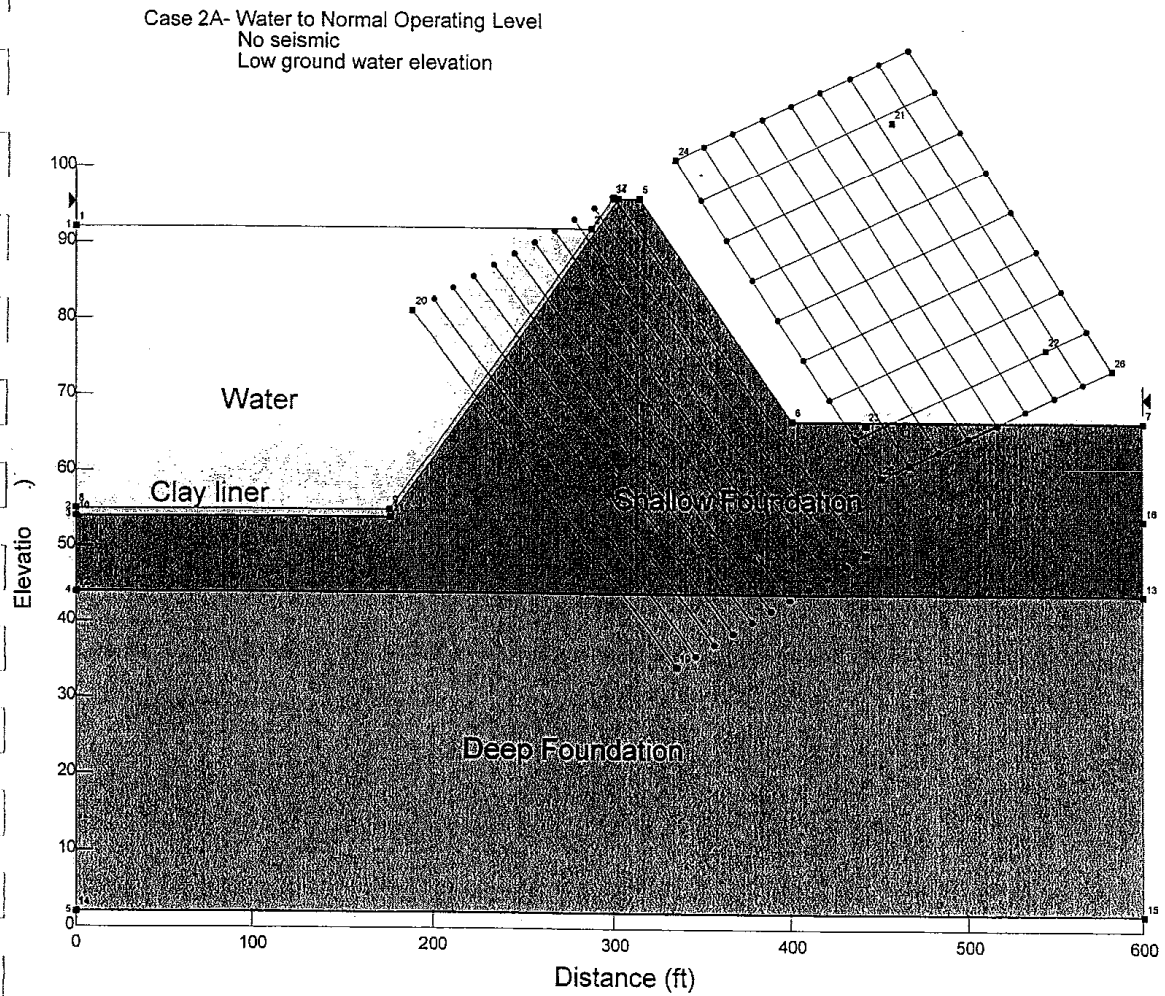
HA 11/4
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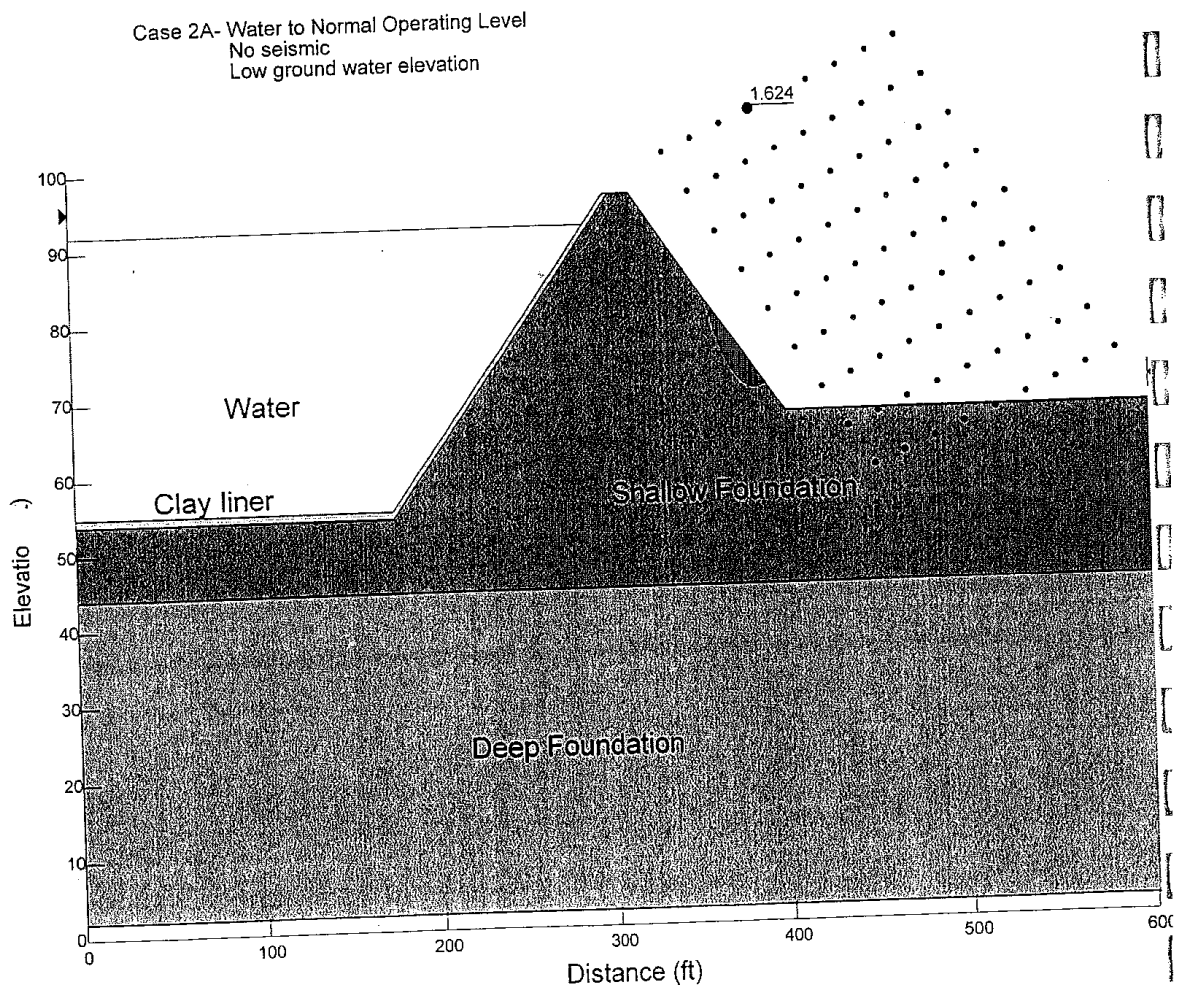
HA 268

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HA 269

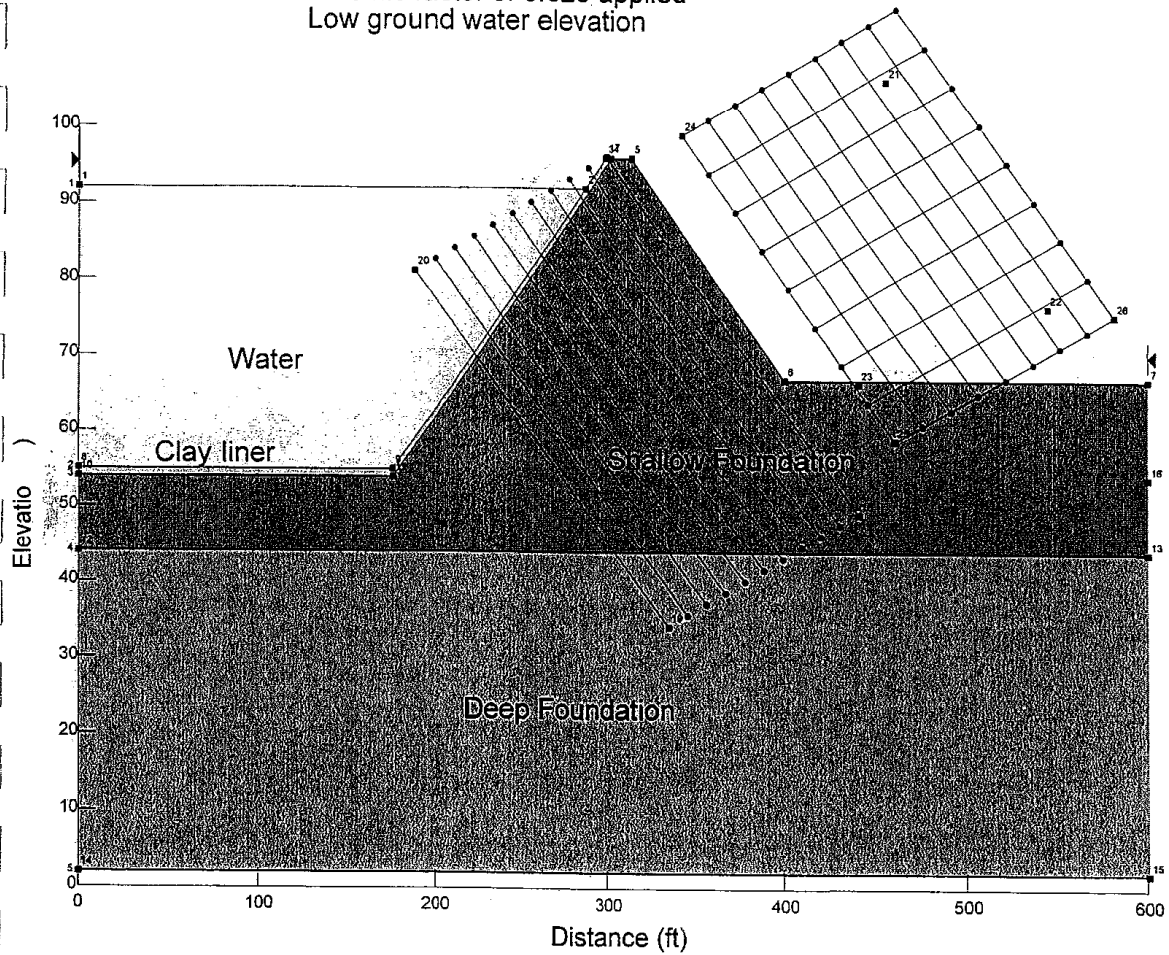
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HA 270

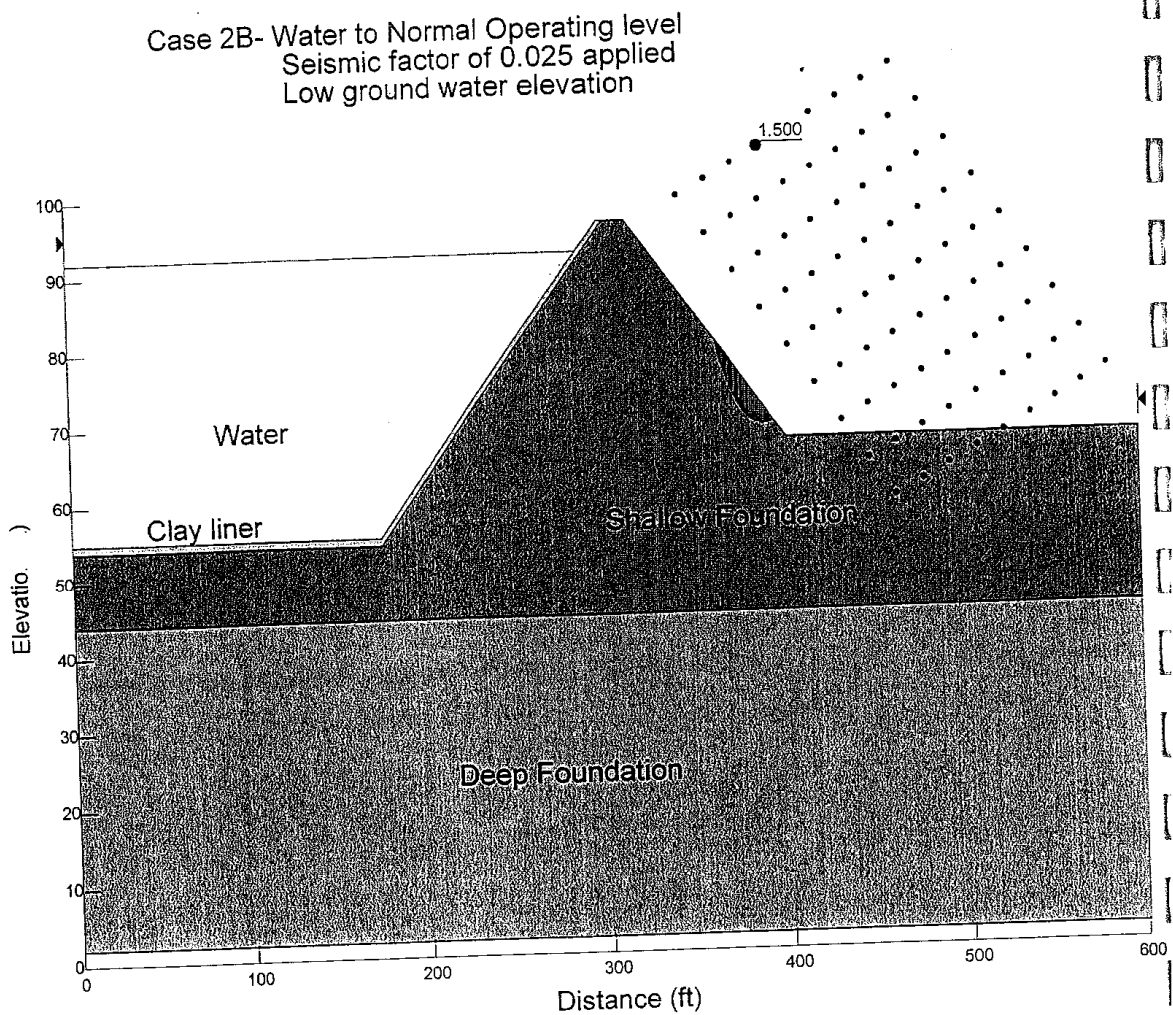
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Case 2B- Water to Normal Operating level
Seismic factor of 0.025 applied
Low ground water elevation



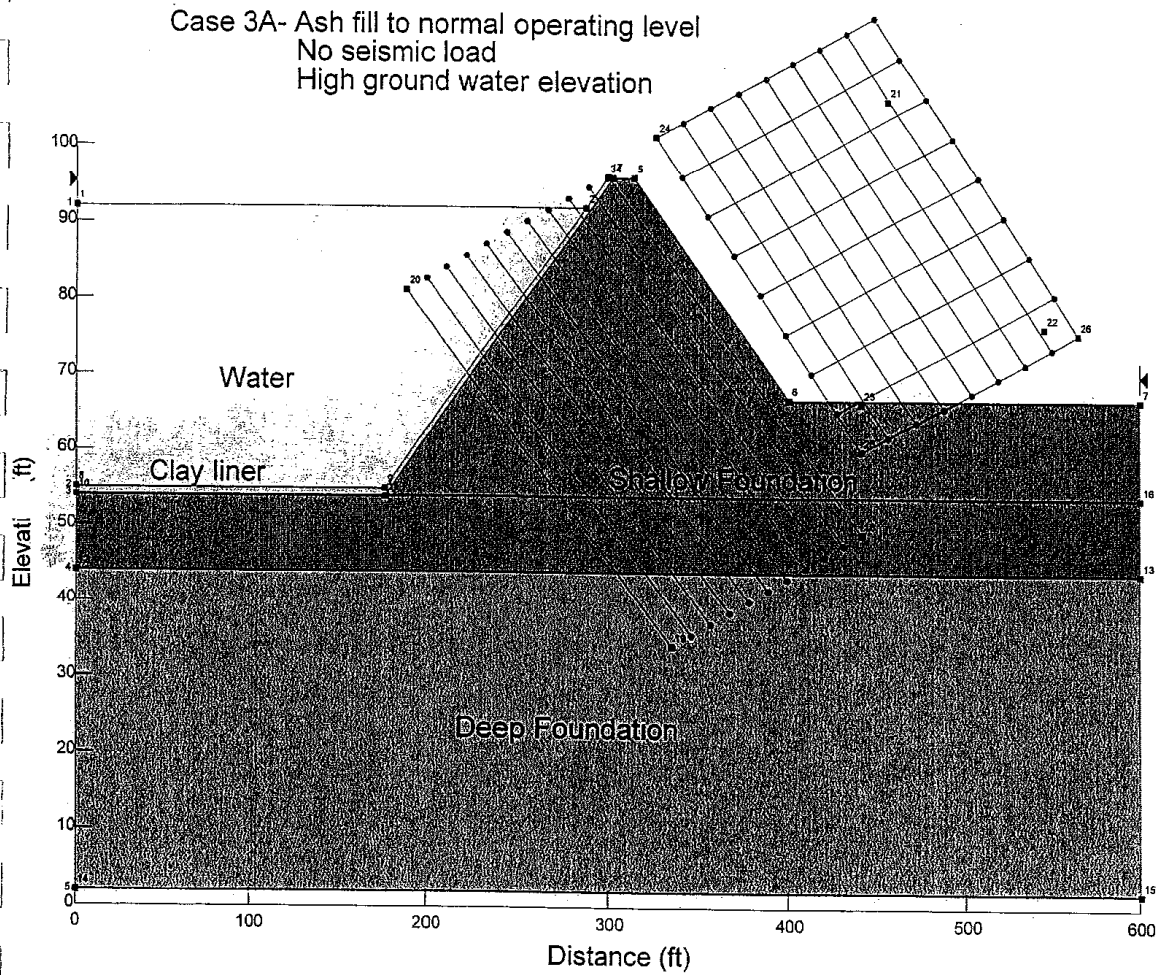
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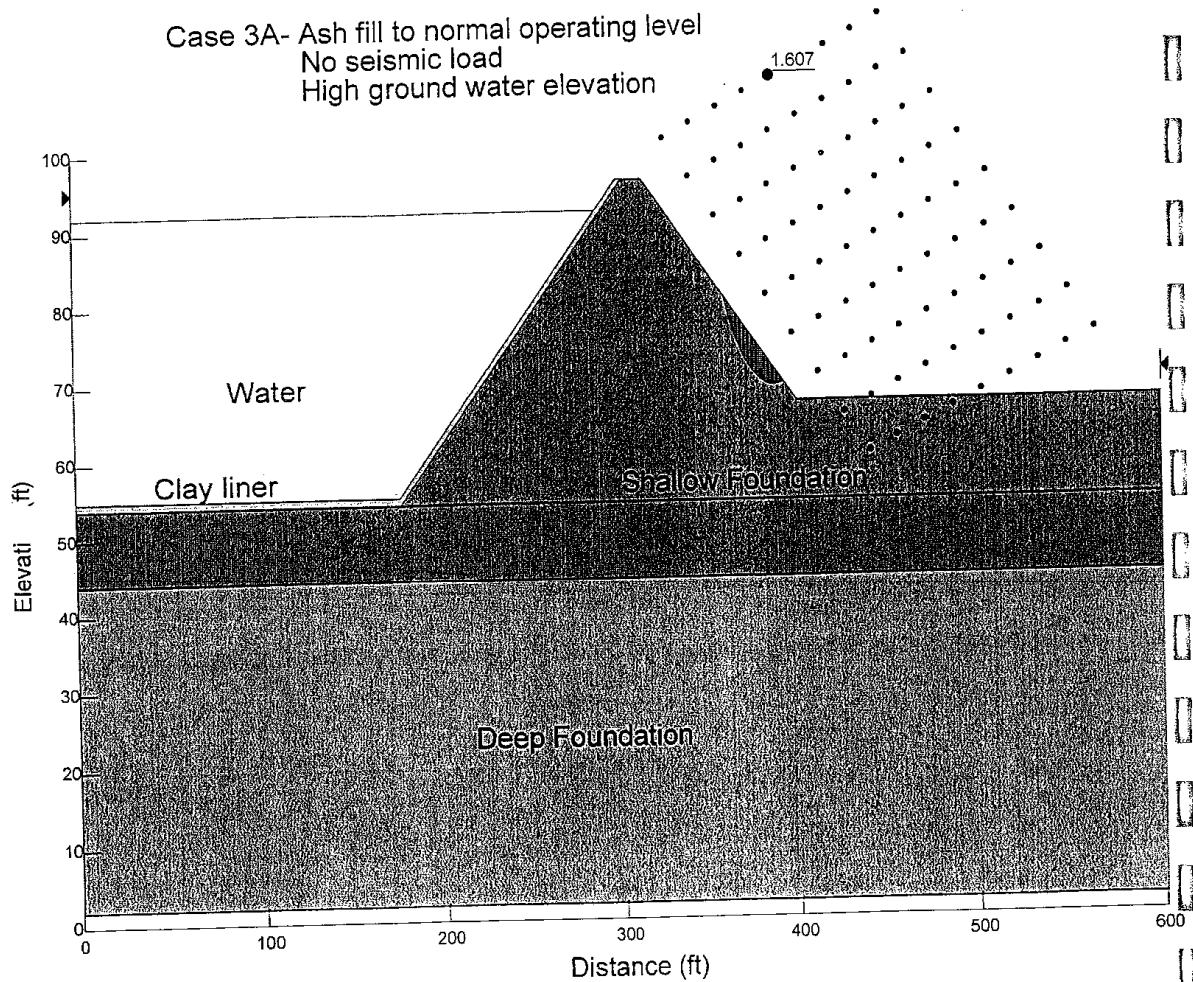
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HA 10/14/13
213

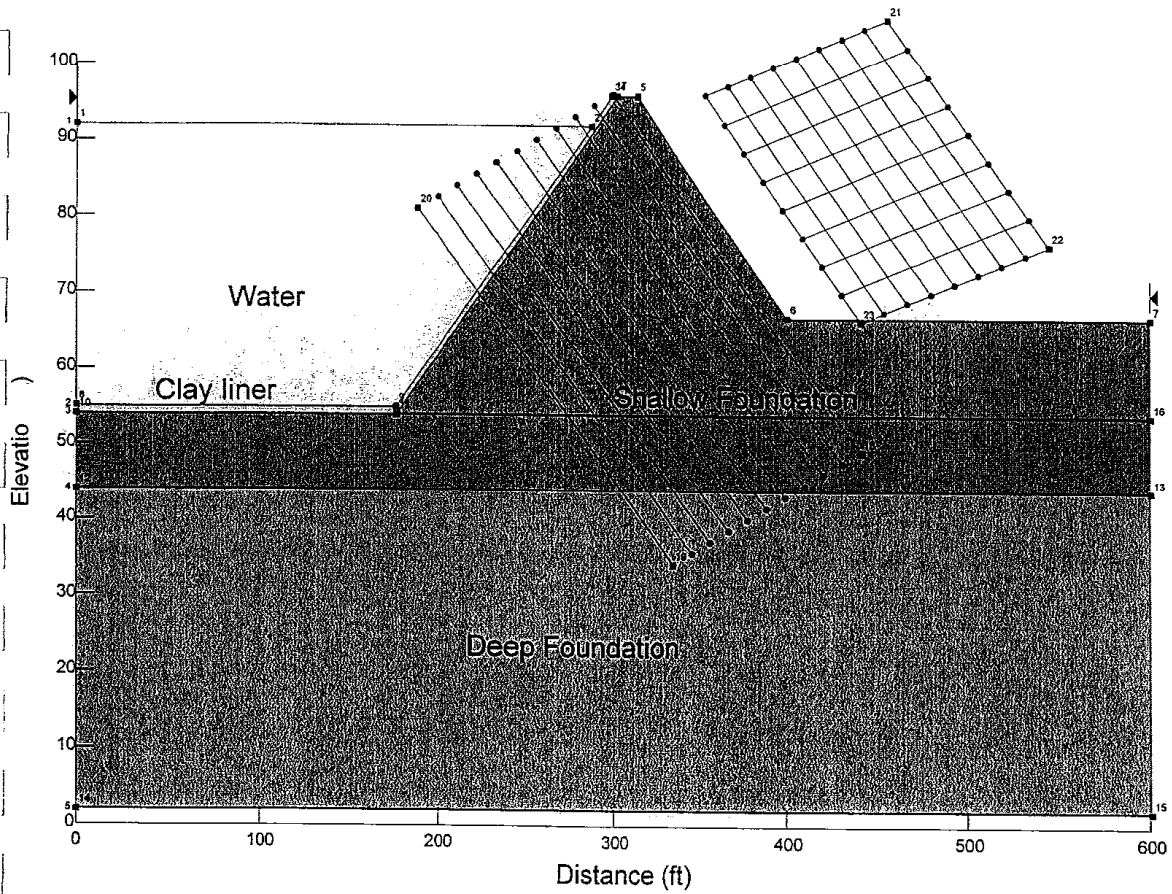
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HA 274

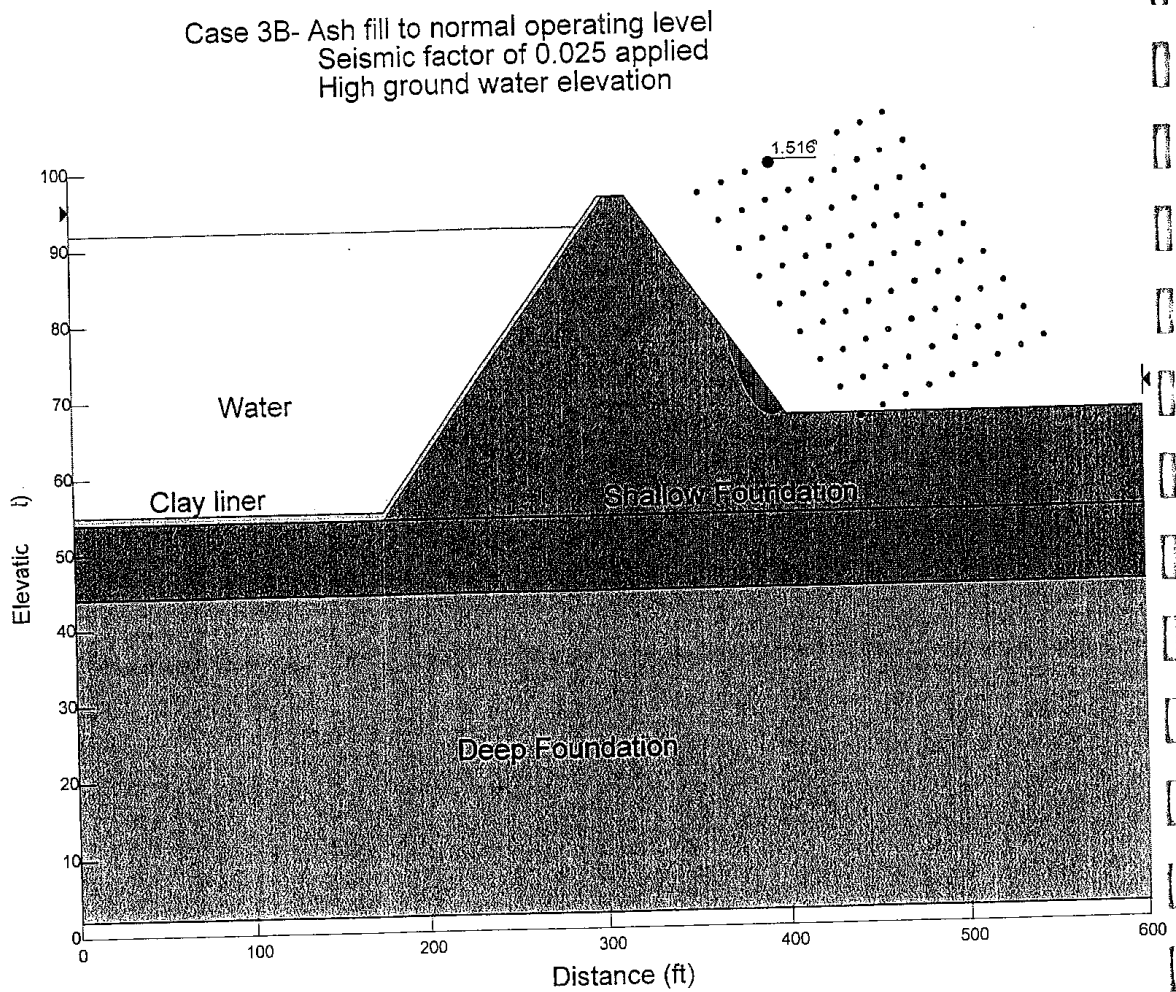
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Case 3B- Ash fill to normal operating level
Seismic factor of 0.025 applied
High ground water elevation



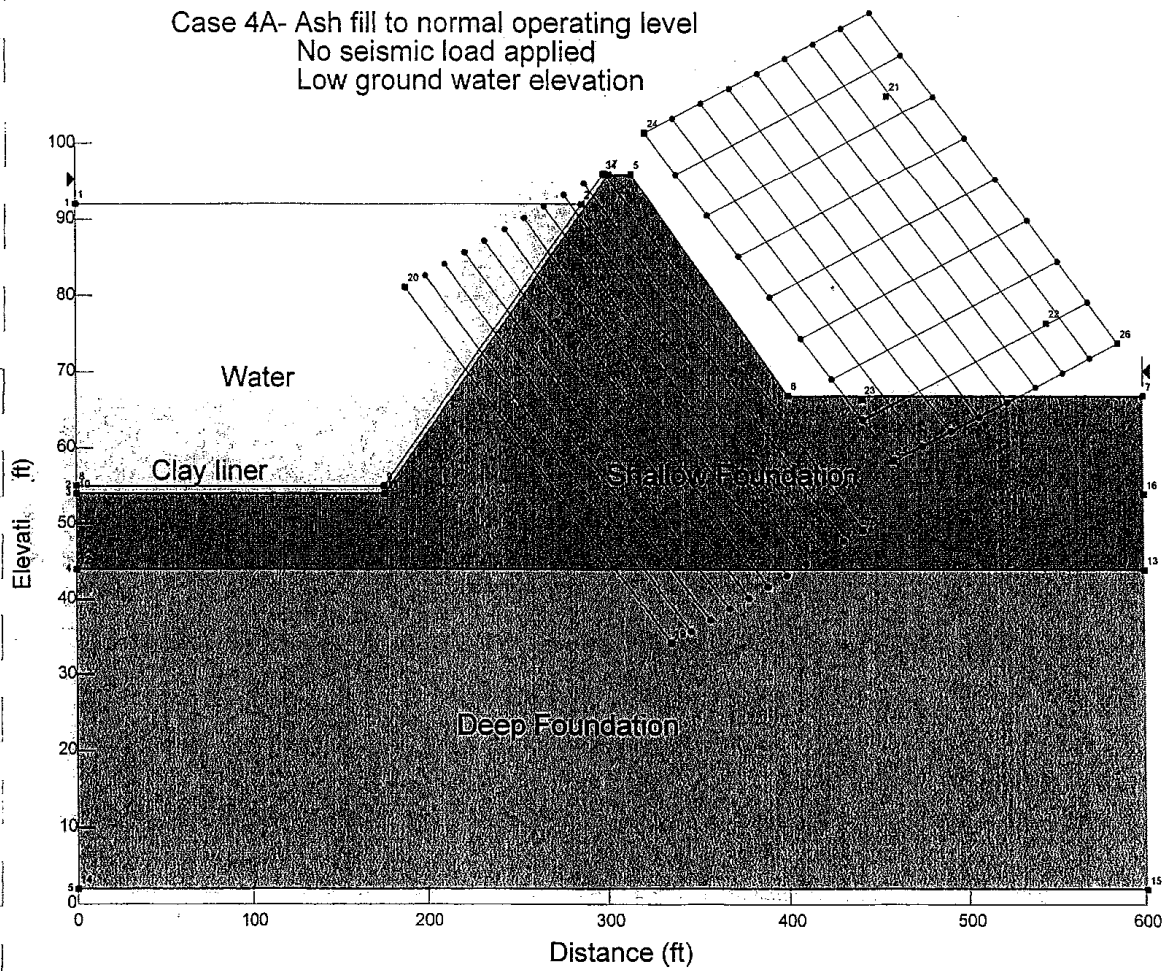
HA 11/15
275

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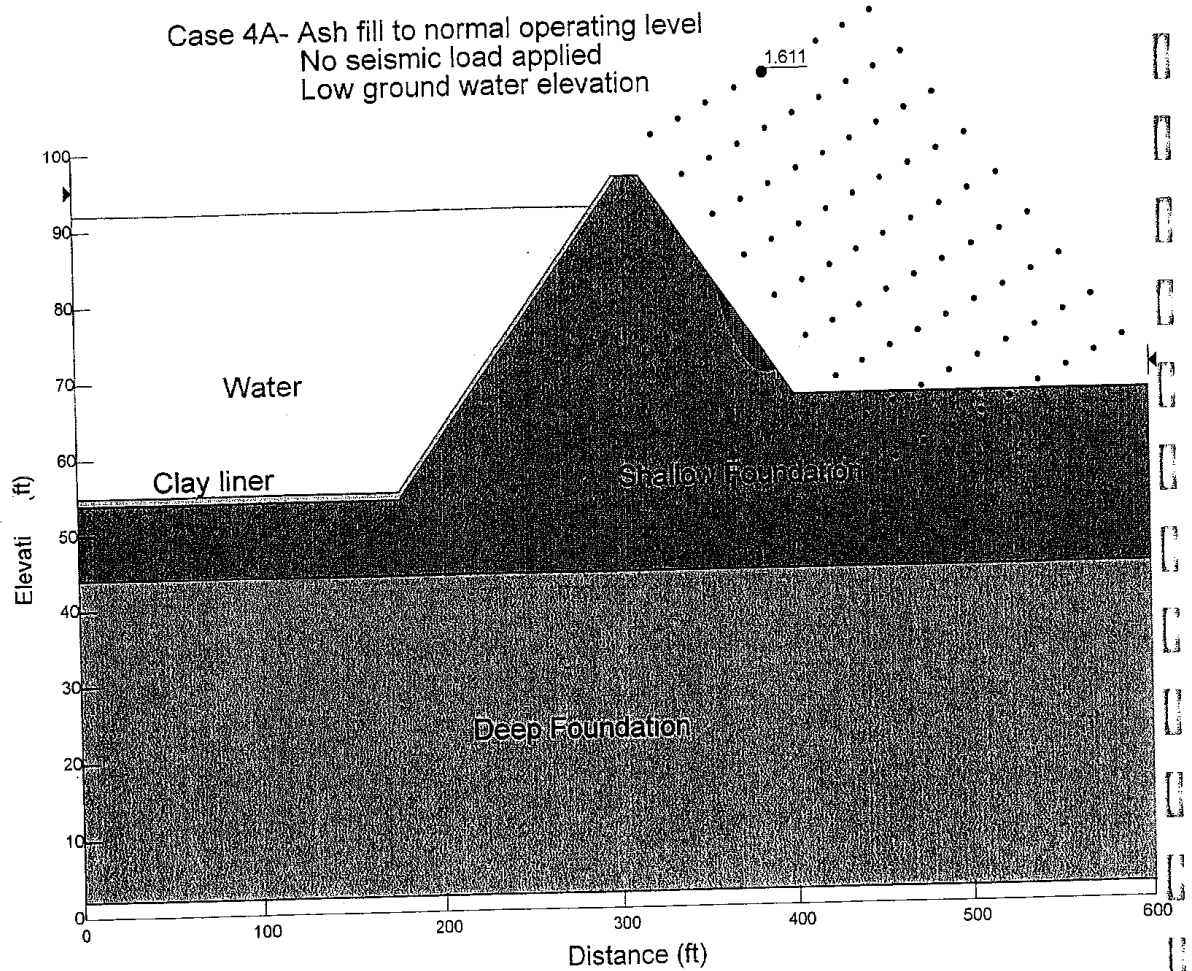


HA 276

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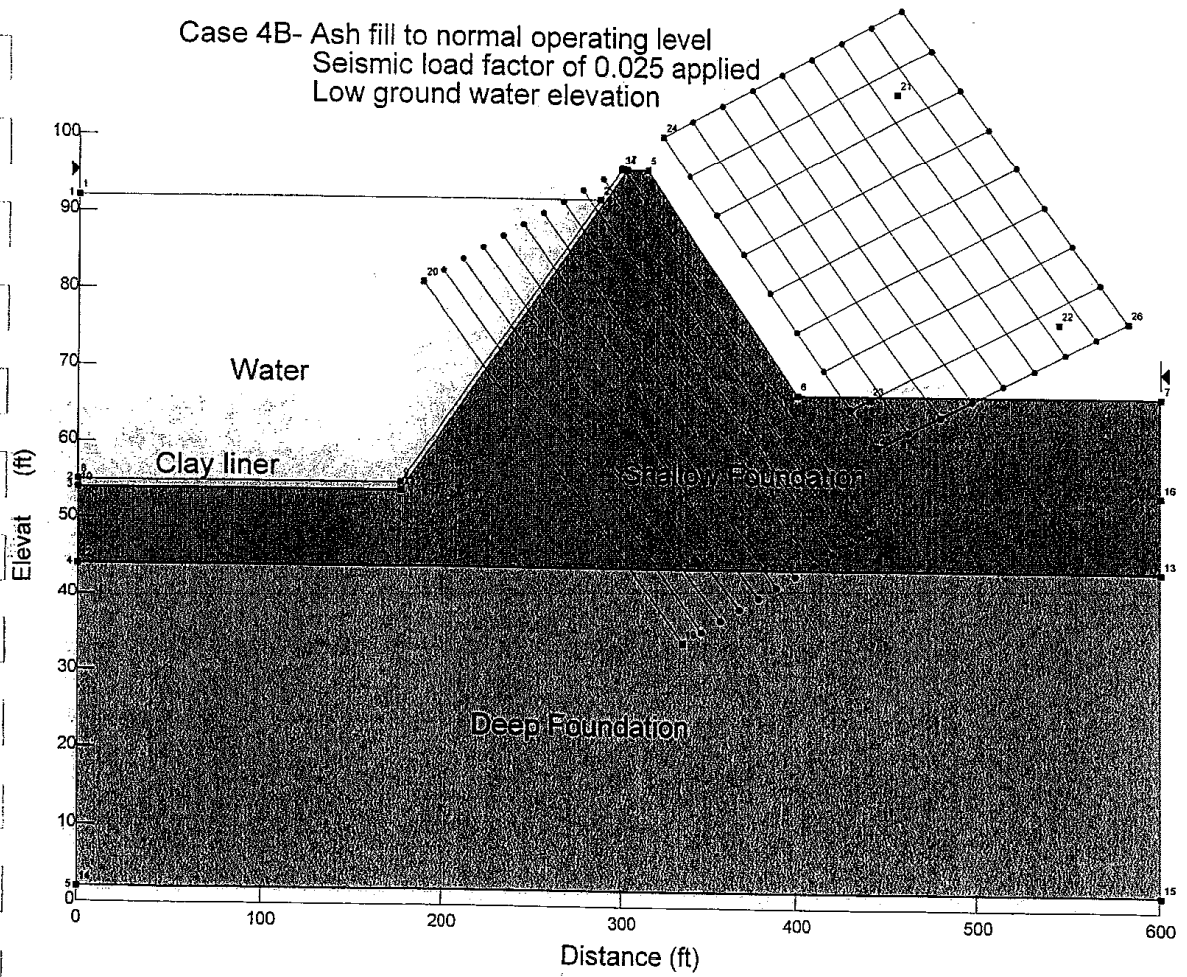


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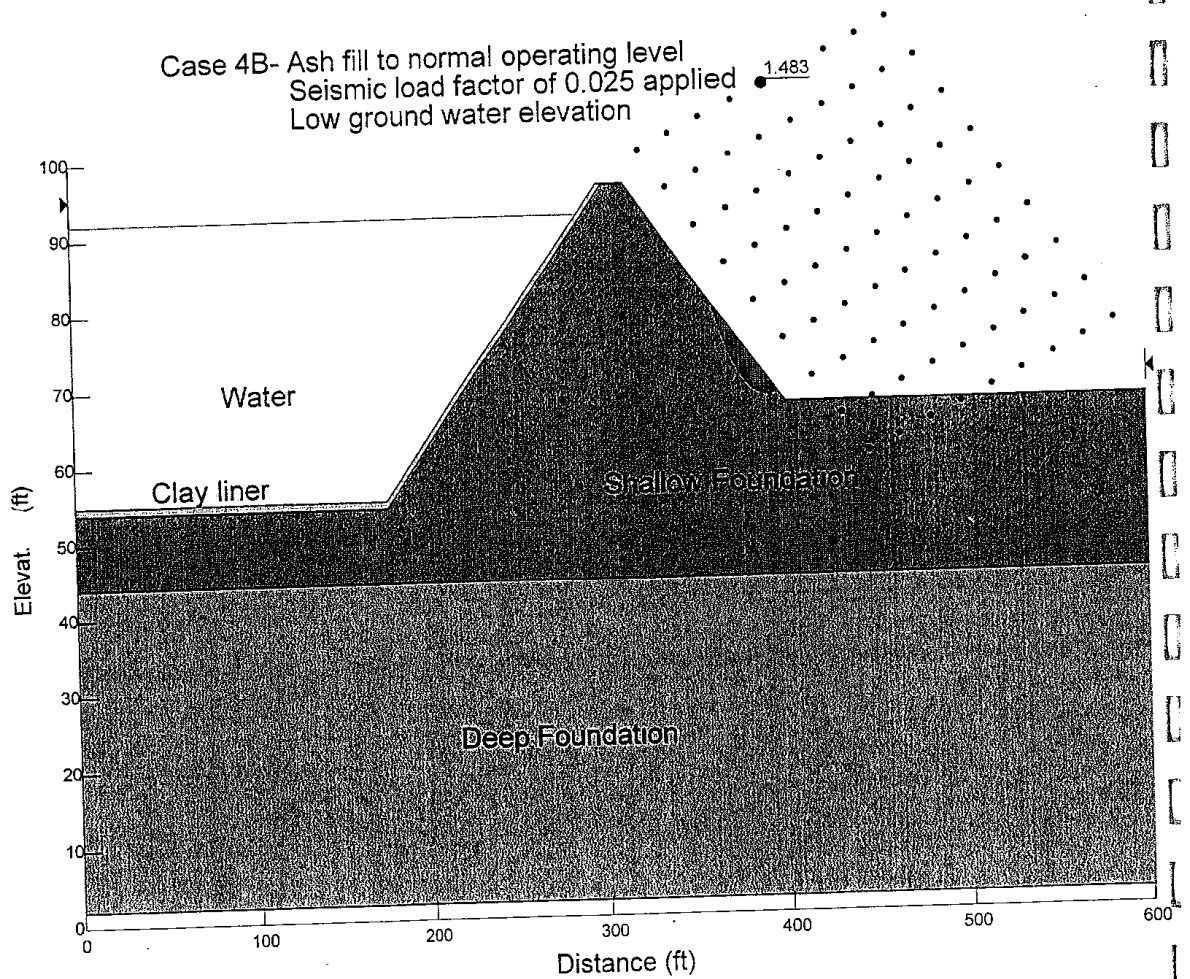
HA 278

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DRAFT



HA 280

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BORING NO. B-01
DATE 6-27-01
W. & A. FILE NO. 1656
SHEET 1 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 467.8
BORING DISCONTINUED AT ELEVATION 406.8

LOCATION Havana, Illinois
DRILLED BY Feh1
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 450.3
GROUND WATER ELEVATION AT 24+ **HRS.** 452.6 **CAVE**
GROUND WATER ELEVATION AT COMPLETION 449.9 **IN**

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	6"						
		SS	9	-	-	-	14
	4						
		SS	10	-	-	-	13
Medium-Density, Light Brown, Fine-Grained SAND	8	SS	15	-	-	-	3
		SS	14	-	-	-	3
	12						
		SS	13	-	-	-	4
	16	SS	12	-	-	-	4
Loose, Light Brown, Fine-Grained SAND	20						
		SS	5	-	-	-	17
	24						
		SS	8	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
 FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 1148
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DRAFT

BORING NO. <u>B-01</u>		BORING LOG (CONTINUATION)		DATE <u>6-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>2</u>		OF <u>34</u>			
LOCATION <u>Havana, Illinois</u>		W. & A. FILE NO. <u>1656</u>					
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 1 of 34 Medium-Density, Light Brown, Fine- To Coarse-Grained SAND And Fine- Grained GRAVEL	30	SS	10	-	-	-	-
	34	SS	19	-	-	-	-
	38	SS	25	-	-	-	-
	42	SS	25	-	-	-	-
	46	SS	26	-	-	-	-
	54	SS	28	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 282

DRAFT

BORING NO. <u>B-01</u>		BORING LOG (CONTINUATION)		DATE <u>6-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>3</u> OF <u>34</u>					
LOCATION <u>Havana, Illinois</u>		W. & A. FILE NO. _____					

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 2 of 34							
Medium-Density, Light Brown, Fine-To Coarse-Grained SAND	60	SS	29	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.


D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

Hn okg
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DRAFT

 WHITNEY & ASSOCIATES INCORPORATED 2406 West Nebraska Avenue PEORIA, ILLINOIS 61604		BORING LOG
BORING NO. <u>B-02</u> DATE <u>6-26-01</u> W. & A. FILE NO. <u>1656</u> SHEET <u>4</u> OF <u>34</u>		
PROJECT <u>ILLINOIS POWER ASH POND EXTENSION</u>		LOCATION <u>Havana, Illinois</u>
BORING LOCATION <u>See Plot Plan Sheet</u>		DRILLED BY <u>Fehl</u>
BORING TYPE <u>Hollow-Stem Auger</u>		WEATHER CONDITIONS <u>Partly Cloudy & Mild</u>
SOIL CLASSIFICATION SYSTEM <u>U. S. B. S. C.</u>		SEEPAGE WATER ENCOUNTERED AT ELEVATION <u>448.5</u>
GROUND SURFACE ELEVATION <u>466.7</u>		GROUND WATER ELEVATION AT <u>24+(P)</u> HRS. <u>451.2</u>
BORING DISCONTINUED AT ELEVATION <u>435.7</u>		GROUND WATER ELEVATION AT COMPLETION <u>450.5</u>

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
<u>Brown SANDY LOAM</u>	<u>3"</u>						
<u>Medium, Dark Brown SANDY CLAY</u>		SS	19	1.1	0.8	112	9
<u>Medium-Density, Brown, Fine-Grained SAND With Considerable Silty Clay</u>	<u>5</u>	SS	19	-	-	-	11
<u>Medium-Density, Light Brown, Fine-Grained SAND</u>		SS	18	-	-	-	4
	<u>10</u>	SS	20	-	-	-	4
<u>Loose, Light Brown, Fine-Grained SAND</u>		SS	9	-	-	-	4
	<u>15</u>	SS	10	-	-	-	6
	<u>20</u>	SS	10	-	-	-	17
<u>Medium-Density, Light Brown, Fine-To Medium-Grained SAND</u>		SS	13	-	-	-	-
	<u>25</u>						
<u>Medium-Density, Light Brown, Fine-To Medium-Grained SAND And Fine-Grained GRAVEL</u>	<u>30</u>	SS	16	-	-	-	-
EXPLORATORY BORING DISCONTINUED							

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.

Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Dd - NATURAL DRY DENSITY - P.C.F.


Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
 PEORIA, ILLINOIS

HA 284

DRAFT

BORING NO. B-03
DATE 6-26-01
W. & A. FILE NO. 1656
SHEET 5 **OF** 34
PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 466.9
BORING DISCONTINUED AT ELEVATION 435.9


WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

LOCATION Havana, Illinois
DRILLED BY Fehl
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 451.8
GROUND WATER ELEVATION AT 24+(P) HRS. 455.7
GROUND WATER ELEVATION AT COMPLETION 454.1 IN

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown, Fine-Grained SAND With Some Organic Vegetation	5'						
		SS	18	-	-	-	5
Medium-Density, Light Brown, Fine-Grained SAND	5						
		SS	17	-	-	-	3
		SS	12	-	-	-	3
-10							
		SS	13	-	-	-	4
Loose, Light Brown, Fine-Grained SAND							
		SS	10	-	-	-	7
	-15						
		SS	8	-	-	-	16
Loose, Orange-Brown, Fine- To Medium-Grained SAND							
	-20						
		SS	7	-	-	-	-
Medium-Density, Orange-Brown, Fine-To Medium-Grained SAND							
	-25						
		SS	20	-	-	-	-
Medium-Density, Gray-Brown, Fine-To Coarse-Grained SAND							
	-30						
		SS	28	-	-	-	-
EXPLORATORY BORING DISCONTINUED							

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE


Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 050
285

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BORING NO B-04
DATE 6-25-01
W. & A. FILE NO. 1656
SHEET 6 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 466.0
BORING DISCONTINUED AT ELEVATION 405.0

LOCATION Havana, Illinois
DRILLED BY Fehl
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 449.5
GROUND WATER ELEVATION AT 24+ **HRS.** -
GROUND WATER ELEVATION AT COMPLETION 451.9

CAVE-I

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
<u>Brown SANDY LOAM Organic Topsoil</u> <u>Soft, Brown And Dark Brown SANDY LOAM</u>	8'						
		SS	5	0.5	0.4	110	11
<u>Medium, Brown SANDY CLAY LOAM</u>	4						
		SS	15	1.2	0.9	114	13
<u>Loose, Brown, Fine- To Medium-Grained SAND</u>	8	SS	7	-	-	-	5
<u>Loose, Light Brown, Fine- To Medium-Grained SAND</u>		SS	6	-	-	-	12
	12						
		SS	5	-	-	-	19
	16	SS	5	-	-	-	18
<u>Very Loose, Brown, Fine- To Medium-Grained SAND With Some Silty Clay</u>	20	SS	3	-	-	-	22
<u>Very Loose, Light Brown, Fine- To Medium-Grained SAND</u>	24	SS	2	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
 Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 D_d - NATURAL DRY DENSITY - P.C.F.
 M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 286

DRAFT

BORING NO. <u>B-04</u>		BORING LOG (CONTINUATION)		DATE <u>6-25-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>7</u> OF <u>34</u>					
LOCATION <u>Havana, Illinois</u>		W. & A. FILE NO. _____					

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 6 of 34							
	30	SS	4	-	-	-	-
	34	SS	3	-	-	-	-
Medium-Density, Light Brown, Medium-To Coarse-Grained SAND And Fine-Grained GRAVEL	38	SS	26	-	-	-	-
Medium-Density, Light Brown And Gray-Brown, Fine- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	46	SS	23	-	-	-	-
	50	SS	25	-	-	-	-
	54	SS	20	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HACB
287

DRAFT

BORING NO. <u>B-04</u>		BORING LOG (CONTINUATION)		DATE <u>6-25-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>8</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 7 of 34							
Medium-Density, Gray-Brown, Medium- To Coarse-Grained SAND And Fine- Grained GRAVEL	60	SS	20	-	-	-	-
EXPLORATORY BORING DISCONTINUED							
	64						
	68						
	72						
	76						
	80						
	84						


N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 278

DRAFT

BORING NO B-05 DATE 6-27-01 W. & A. FILE NO. 1656 SHEET 9 OF 34		WHITNEY & ASSOCIATES <small>INCORPORATED</small> 2406 West Nebraska Avenue PEORIA, ILLINOIS 61604	BORING LOG
PROJECT ILLINOIS POWER ASH POND EXTENSION		LOCATION Havana, Illinois	
BORING LOCATION See Plot Plan Sheet		DRILLED BY Fehl	
BORING TYPE Hollow-Stem Auger		WEATHER CONDITIONS Partly Cloudy & Mild	
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.		SEEPAGE WATER ENCOUNTERED AT ELEVATION 452.1	
GROUND SURFACE ELEVATION 466.9		GROUND WATER ELEVATION AT 24+ HRS. 456.2 CAVE IN	
BORING DISCONTINUED AT ELEVATION 405.9		GROUND WATER ELEVATION AT COMPLETION 451.1	

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM Organic Topsoil	4"						
Loose, Brown, Fine-Grained SAND With Considerable Silty Clay		SS	10	-	-	107	13
Medium, Brown SANDY CLAY LOAM	4						
		SS	12	0.7	0.5	100	20
Loose, Light Brown, Fine-Grained SAND	8	SS	8	-	-	-	8
		SS	5	-	-	-	14
	12						
		SS	8	-	-	-	16
Loose, Light Brown, Fine- To Medium-Grained SAND	16	SS	10	-	-	-	19
Loose, Brown, Fine-Grained SAND With Some Silt	20	SS	9	-	-	-	-
	24						
Loose Brown, Fine- To Medium-Grained SAND With Some Coarse-Grained Sand		SS	8	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.

Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Dd - NATURAL DRY DENSITY - P.C.F.

Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 1050
289

DRAFT

BORING NO. <u>B-05</u>		BORING LOG (CONTINUATION)		DATE <u>6-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>10</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 9 of 34							
Medium-Density, Light Brown And Brown, Fine-Grained SAND	30	SS	15	-	-	-	-
	34	SS	20	-	-	-	-
	38						
	42	SS	21	-	-	-	-
Medium-Density, Brown, Medium- To Coarse-Grained SAND	46	SS	16	-	-	-	-
Medium-Density, Brown, Medium- To Coarse-Grained SAND With Some Fine-Grained Gravel	50	SS	18	-	-	-	-
Medium-Density, Brown, Medium- To Coarse-Grained SAND	54	SS	21	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HX 290

DRAFT

BORING NO. <u>B-05</u>		BORING LOG (CONTINUATION)		DATE <u>06-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>11</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 10 of 34							
	60	SS	23	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE


Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

HA *[Signature]*
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WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

DRAFT

BORING NO B-06
DATE 6-25-01
W. & A. FILE NO. 1656
SHEET 12 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 460.6
BORING DISCONTINUED AT ELEVATION 429.6

LOCATION Havana, Illinois
DRILLED BY FehI
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 449.4
GROUND WATER ELEVATION AT 24+(P) **HRS.** 451.3
GROUND WATER ELEVATION AT COMPLETION 448.8

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM Medium-Density, Light Brown, Fine-Grained SAND	8"						
		SS	12	-	-	-	6
Loose, Light Brown, Fine-Grained SAND	5						
		SS	7	-	-	-	3
Very Loose, Brown, Fine-Grained SAND							
		SS	4	-	-	-	18
	10						
		SS	3	-	-	-	18
Loose, Brown, Fine-Grained SAND							
		SS	7	-	-	-	19
	15						
		SS	9	-	-	-	-
Medium-Density, Brown, Fine-Grained SAND							
	20						
		SS	12	-	-	-	-
	25						
		SS	13	-	-	-	-
Medium-Density, Brown, Medium- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL							
	30						
		SS	23	-	-	-	-
EXPLORATORY BORING DISCONTINUED							

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE


Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 292

DRAFT

BORING NO. B-07
DATE 6-26-01
W. & A. FILE NO. 1656
SHEET 13 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 470.0
BORING DISCONTINUED AT ELEVATION 439.0

LOCATION Havana, Illinois
DRILLED BY Fehl
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 451.5
GROUND WATER ELEVATION AT 24+(P) HRS. 452.8
GROUND WATER ELEVATION AT COMPLETION 451.7

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM	4						
Loose, Brown, Fine-Grained SAND With Considerable Silty Clay		SS	5	-	-	102	14
Medium, Brown SANDY LOAM	5						
		SS	6	0.8	0.5	100	14
Loose, Brown, Fine-Grained SAND							
		SS	4	-	-	-	14
	10						
		SS	4	-	-	-	13
		SS	6	-	-	-	6
Loose, Brown, Fine- To Coarse-Grained SAND	15						
		SS	6	-	-	-	4
Loose, Brown, Fine-Grained SAND							
	20						
		SS	4	-	-	-	19
	25						
		SS	7	-	-	-	-
Medium-Density, Brown, Fine-Grained SAND	30						
		SS	17	-	-	-	-
EXPLORATORY BORING DISCONTINUED							

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE


Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 284
293

DRAFT

BORING NO. B-08
DATE 6-26-01
W. & A. FILE NO. 1656
SHEET 14 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 474.6
BORING DISCONTINUED AT ELEVATION 443.6

LOCATION Havana, Illinois
DRILLED BY Fehl
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 451.4
GROUND WATER ELEVATION AT 24+ (P) **HRS.** 465.1 **CAVE**
GROUND WATER ELEVATION AT COMPLETION 453.8 **IN**

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
Brown SANDY LOAM Loose, Light Brown, Fine-Grained SAND With Some Silty Clay	3"						
		SS	6	-	-	-	8
	5						
		SS	6	-	-	-	6
Loose, Light Brown, Fine- To Medium- Grained SAND							
		SS	5	-	-	-	8
	10						
		SS	6	-	-	-	9
Medium-Density, Light Brown, Fine- Grained SAND							
		SS	9	-	-	-	4
	15						
		SS	16	-	-	-	5
Loose, Light Brown, Fine-Grained SAND	20						
		SS	16	-	-	-	18
	25						
		SS	8	-	-	-	-
EXPLORATORY BORING DISCONTINUED	30						
		SS	10	-	-	-	-


N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
 FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
 Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 D_d - NATURAL DRY DENSITY - P.C.F.
 M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

Hx 294

DRAFT

BORING NO B-09 DATE 6-26-01 W. & A. FILE NO. 1656 SHEET 15 OF 34	 <div style="margin-top: 10px;"> WHITNEY & ASSOCIATES <small>INCORPORATED</small> 2406 West Nebraska Avenue PEORIA, ILLINOIS 61604 </div>	BORING LOG LOCATION Havana, Illinois DRILLED BY Fehl WEATHER CONDITIONS Partly Cloudy & Mild SEEPAGE WATER ENCOUNTERED AT ELEVATION 454.3 GROUND SURFACE ELEVATION 488.7 GROUND WATER ELEVATION AT 24+ HRS. 477.2 CAVE BORING DISCONTINUED AT ELEVATION 427.7 GROUND WATER ELEVATION AT COMPLETION 468.9 IN
PROJECT ILLINOIS POWER ASH POND EXTENSION BORING LOCATION See Plot Plan Sheet BORING TYPE Hollow-Stem Auger SOIL CLASSIFICATION SYSTEM U. S. B. S. C. GROUND SURFACE ELEVATION 488.7 BORING DISCONTINUED AT ELEVATION 427.7		

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Some Silty Clay	4"						
		SS	6	-	-	-	6
	4						
		SS	7	-	-	-	5
Loose, Brown, Fine-Grained SAND	8	SS	6	-	-	-	6
		SS	6	-	-	-	5
	12						
		SS	8	-	-	-	6
	16	SS	10	-	-	-	7
Medium-Density, Light Brown, Fine-Grained SAND	20	SS	15	-	-	-	4
	24						
		SS	18	-	-	-	2

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
 Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 D_d - NATURAL DRY DENSITY - P.C.F.
 M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 1656 295

DRAFT

BORING NO. <u>B-09</u>		BORING LOG (CONTINUATION)		DATE <u>6-26-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>16</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 15 of 34							
	30	SS	25	-	-	-	-
	34	SS	16	-	-	-	-
Medium-Density, Light Brown, Fine-To Medium-Grained SAND	38						
		SS	26	-	-	-	-
	42						
Medium-Density, Light Brown, Fine-Grained SAND		SS	24	-	-	-	-
	46						
Medium-Density, Light Brown, Fine-Grained SAND With Fine-Grained Gravel	50	SS	26	-	-	-	-
Medium-Density, Light Brown, Medium-To Coarse-Grained SAND	54	SS	28	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 296

DRAFT

BORING NO <u>B-09</u>		BORING LOG (CONTINUATION)		DATE <u>06-26-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>17</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 16 of 34							
Dense, Light Brown, Medium- To Coarse-Grained SAND With Fine-Grained Gravel	60	SS	31	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE


Q_p - CALIBRATED PENETROMETER READING - T.S.F.
 Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 D_d - NATURAL DRY DENSITY - P.C.F.
 M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 256
297

DRAFT

BORING NO. B-10
DATE 6-26-01
W. & A. FILE NO. 1656
SHEET 18 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 475.3
BORING DISCONTINUED AT ELEVATION 414.3

LOCATION Havana, Illinois
DRILLED BY Fehl
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 452.7
GROUND WATER ELEVATION AT 24+ **HRS.** 462.5 CAVE
GROUND WATER ELEVATION AT COMPLETION 455.7 IN

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Some Silty Clay	8"						
		SS	6	-	-	-	6
	4						
		SS	7	-	-	-	8
Loose, Light Brown, Fine-Grained SAND							
	8	SS	7	-	-	-	17
		SS	8	-	-	-	14
	12						
		SS	10	-	-	-	7
		SS	13	-	-	-	6
Medium-Density, Light Brown, Fine-Grained SAND	16						
	20	SS	9	-	-	-	3
Loose, Light Brown, Fine- To Medium-Grained SAND	24						
		SS	8	-	-	-	19

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 298

DRAFT

BORING NO. <u>B-10</u>		BORING LOG (CONTINUATION)		DATE <u>6-26-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>19</u>		OF <u>34</u>			
LOCATION <u>Havana, Illinois</u>		W. & A. FILE NO. <u>1656</u>					
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 18 of 34							
Medium-Density, Light Brown, Fine- To Medium-Grained SAND	30	SS	13	-	-	-	-
	34	SS	16	-	-	-	-
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND And Fine- Grained GRAVEL	38	SS	25	-	-	-	-
Medium-Density, Light Brown, Medium- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	42	SS	25	-	-	-	-
Medium-Density, Dark Brown, Fine- To Coarse-Grained SAND	50	SS	26	-	-	-	-
Dense, Dark Brown, Fine- To Coarse- Grained SAND	54	SS	36	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 06/27/01
299

DRAFT

BORING NO. <u>B-10</u>		BORING LOG (CONTINUATION)		DATE <u>06-26-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>20</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 19 of 34							
Dense, Dark Brown, Medium- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	60	SS	35	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.


M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 300

DRAFT

BORING NO. B-11
DATE 6-28-01
W. & A. FILE NO. 1656
SHEET 21 **OF** 34


WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION **LOCATION** Havana, Illinois
BORING LOCATION See Plot Plan Sheet **DRILLED BY** Fehl
BORING TYPE Hollow-Stem Auger **WEATHER CONDITIONS** Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U. S. B. S. C. **SEEPAGE WATER ENCOUNTERED AT ELEVATION** 452.7
GROUND SURFACE ELEVATION 467.6 **GROUND WATER ELEVATION AT** 24+(P) **HRS.** 453.1
BORING DISCONTINUED AT ELEVATION 436.6 **GROUND WATER ELEVATION AT COMPLETION** 452.4

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM	7"						
Loose, Light Brown, Fine-Grained SAND With Some Silty Clay		SS	8	-	-	-	9
Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	5	SS	9	-	-	-	11
Loose, Brown, Fine-Grained SAND		SS	6	-	-	-	10
Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	10	SS	5	-	-	-	16
Loose, Brown, Fine-Grained SAND		SS	5	-	-	-	19
	15	SS	4	-	-	-	-
	20	SS	8	-	-	-	-
Medium-Density, Light Brown, Fine-To Coarse-Grained SAND	25	SS	12	-	-	-	-
Medium-Density, Light Brown, Fine-Grained SAND	30	SS	16	-	-	-	-
EXPLORATORY BORING DISCONTINUED							

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 008
301

DRAFT

BORING NO. <u>B-12</u>		BORING LOG (CONTINUATION)		DATE <u>06-25-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>24</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 23 of 34							
Dense, Gray-Brown, Fine- To Medium-Grained SAND And Fine-Grained GRAVEL	60	SS	35	-	-	-	-
EXPLORATORY BORING DISCONTINUED							
	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.


D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HAX 302

DRAFT

BORING NOB-13 DATE <u>6-25-01</u> W. & A. FILE NO. <u>1656</u> SHEET <u>25</u> OF <u>34</u>	 WHITNEY & ASSOCIATES <small>INCORPORATED</small> 2408 West Nebraska Avenue PEORIA, ILLINOIS 61604	BORING LOG LOCATION <u>Havana, Illinois</u> DRILLED BY <u>Fehl</u> WEATHER CONDITIONS <u>Partly Cloudy & Mild</u> SEEPAGE WATER ENCOUNTERED AT ELEVATION <u>449.0</u> GROUND SURFACE ELEVATION <u>466.5</u> GROUND WATER ELEVATION AT <u>24+</u> HRS. <u>455.9</u> BORING DISCONTINUED AT ELEVATION <u>405.5</u> GROUND WATER ELEVATION AT COMPLETION <u>448.6</u>
PROJECT <u>ILLINOIS POWER ASH POND EXTENSION</u> BORING LOCATION <u>See Plot Plan Sheet</u> BORING TYPE <u>Hollow-Stem Auger</u>		

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM	7*						
Loose, Light Brown And Brown, Fine-Grained SAND With Some Silty Clay		SS	7	-	-	-	11
	4						
		SS	9	-	-	-	10
Very Loose, Light Brown, Fine-Grained SAND	8	SS	4	-	-	-	6
		SS	3	-	-	-	4
Loose, Light Brown, Fine-Grained SAND	12						
		SS	6	-	-	-	6
	16	SS	8	-	-	-	10
Loose, Light Brown, Fine- To Medium-Grained SAND							
	20	SS	8	-	-	-	18
	24	SS	10	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 1009
203

DRAFT

BORING LOG		DATE <u>6-25-01</u>	
(CONTINUATION)			
BORING NO. <u>B-13</u>		SHEET <u>26</u> OF <u>34</u>	
PROJECT <u>Illinois Power Ash Pond Extension</u>		W. & A. FILE NO. <u>1656</u>	
LOCATION <u>Havana, Illinois</u>			

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 25 of 34							
Medium-Density, Gray-Brown, Medium- To Coarse-Grained SAND And Fine- Grained GRAVEL	30	SS	12	-	-	-	-
	34	SS	13	-	-	-	-
	38						
	42	SS	16	-	-	-	-
Medium-Density, Brown, Fine- To Medium-Grained SAND	46	SS	20	-	-	-	-
Medium-Density, Brown, Medium- To Coarse-Grained SAND	50	SS	23	-	-	-	-
	54	SS	18	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
 PEORIA, ILLINOIS

HA 304

DRAFT

BORING NO. <u>B-13</u>		BORING LOG (CONTINUATION)		DATE <u>06-25-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>				SHEET <u>27</u> OF <u>34</u>			
LOCATION <u>Havana, Illinois</u>				W. & A. FILE NO. <u>1656</u>			
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 26 of 34							
Medium-Density, Brown, Fine- To Medium-Grained SAND	60	SS	17	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.


M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA W&A
305

DRAFT

BORING NO. B-14
DATE 6-28-01
W. & A. FILE NO. 1656
SHEET 28 **OF** 34


WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 481.9
BORING DISCONTINUED AT ELEVATION 450.9

LOCATION Havana, Illinois
DRILLED BY Feh1
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 466.8
GROUND WATER ELEVATION AT 24+(P) HRS. 454.4
GROUND WATER ELEVATION AT COMPLETION 453.8

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM Loose, Gray Brown, Fine-Grained SAND With Some Silty Clay	6"						
		SS	8	-	-	-	9
Loose, Light Brown, Fine-Grained SAND	5						
		SS	7	-	-	-	8
Medium-Density, Dark Brown, Fine-Grained SAND With Considerable Silty Clay							
		SS	10	-	-	-	9
Medium-Density, Brown, Fine-Grained SAND With Some Silty Clay	10						
		SS	11	-	-	-	15
Medium-Density, Brown, Fine-Grained SAND With Some Silty Clay							
		SS	12	-	-	-	14
Medium-Density, Light Brown, Fine-Grained SAND	15						
		SS	15	-	-	-	20
Medium-Density, Light Brown, Fine-To Medium-Grained SAND	20						
		SS	13	-	-	-	5
Medium-Density, Light Brown, Fine-To Medium-Grained SAND	25						
		SS	15	-	-	-	5
EXPLORATORY BORING DISCONTINUED	30						
		SS	13	-	-	-	15

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE


Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

306

DRAFT

BORING NO. B-15
DATE 6-27-01
W. & A. FILE NO. 1656
SHEET 29 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION

LOCATION Havana, Illinois

BORING LOCATION See Plot Plan Sheet

DRILLED BY Fehl

BORING TYPE Hollow-Stem Auger

WEATHER CONDITIONS Partly Cloudy & Mild

SOIL CLASSIFICATION SYSTEM U. S. B. S. C.

SEEPAGE WATER ENCOUNTERED AT ELEVATION 450.8

GROUND SURFACE ELEVATION 473.2

GROUND WATER ELEVATION AT 24+ **HRS.** 451.4

BORING DISCONTINUED AT ELEVATION 412.2

GROUND WATER ELEVATION AT COMPLETION 449.6

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM	5						
Loose, Brown, Fine-Grained SAND With Some Silty Clay		SS	5	-	-	-	10
	4						
		SS	6	-	-	-	11
Loose, Brown, Fine-Grained SAND With Trace Of Silty Clay							
	8	SS	8	-	-	-	9
Loose, Light Brown, Fine-Grained SAND							
		SS	9	-	-	-	8
	12						
Medium-Density, Light Brown, Fine- Grained SAND		SS	13	-	-	-	8
	16	SS	17	-	-	-	3
Loose, Light Brown, Fine-Grained SAND							
	20	SS	8	-	-	-	4
Loose, Light Brown, Fine- To Medium-Grained SAND	24	SS	8	-	-	-	16

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.

Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Dd - NATURAL DRY DENSITY - P.C.F.

Mc - NATURAL MOISTURE CONTENT - %

HA 24 307

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

DRAFT

BORING NO <u>B-15</u>		BORING LOG (CONTINUATION)		DATE <u>6-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>30</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 29 of 34							
Medium-Density, Light Brown, Fine- To Medium-Grained SAND	30	SS	15	-	-	-	-
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND And Fine- Grained GRAVEL	34	SS	18	-	-	-	-
	38						
	42	SS	23	-	-	-	-
Medium-Density, Light Brown, Medium- To Coarse-Grained SAND And Fine- Grained GRAVEL	46	SS	24	-	-	-	-
	50	SS	23	-	-	-	-
	54	SS	24	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HAX 308

DRAFT

BORING NO. <u>B-15</u>		BORING LOG (CONTINUATION)		DATE <u>06-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>31</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 30 of 34							
Medium-Density, Light Brown, Fine- To Medium-Grained SAND	60	SS	26	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER
FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE


Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HAVANA
309

DRAFT

BORING NO. B-16
DATE 6-27-01
W. & A. FILE NO. 1656
SHEET 32 **OF** 34



WHITNEY & ASSOCIATES
INCORPORATED
 2406 West Nebraska Avenue
 PEORIA, ILLINOIS 61604

BORING LOG

PROJECT ILLINOIS POWER ASH POND EXTENSION
BORING LOCATION See Plot Plan Sheet
BORING TYPE Hollow-Stem Auger
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
GROUND SURFACE ELEVATION 468.9
BORING DISCONTINUED AT ELEVATION 407.9

LOCATION Havana, Illinois
DRILLED BY Fehl
WEATHER CONDITIONS Partly Cloudy & Mild
SEEPAGE WATER ENCOUNTERED AT ELEVATION 450.1
GROUND WATER ELEVATION AT 24+ **HRS.** 451.4
GROUND WATER ELEVATION AT COMPLETION 449.7

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SANDY LOAM	8"						
Loose, Brown And Light Brown, Fine-Grained SAND With Some Silty Clay		SS	8	-	-	-	9
	4						
		SS	9	-	-	-	11
Medium-Density, Brown And Light Brown, Fine-Grained SAND							
	8	SS	15	-	-	-	3
		SS	19	-	-	-	4
Medium-Density, Light Brown, Fine-To Medium-Grained SAND							
	12						
		SS	16	-	-	-	7
Medium-Density, Light Brown, Fine-Grained SAND							
	16	SS	14	-	-	-	4
Loose, Light Brown, Fine-To Medium-Grained SAND							
	20	SS	8	-	-	-	17
	24						
		SS	5	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
 SS - SPLIT SPOON SAMPLE
 ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
 Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
 Dd - NATURAL DRY DENSITY - P.C.F.
 Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 310

DRAFT

BORING NO. <u>B-16</u>		BORING LOG (CONTINUATION)		DATE <u>6-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>				SHEET <u>33</u>		OF <u>34</u>	
LOCATION <u>Havana, Illinois</u>				W. & A. FILE NO. <u>1656</u>			
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 32 of 34							
Medium-Density, Light Brown And Gray-Brown, Fine- To Medium-Grained SAND	30	SS	15	-	-	-	-
	34	SS	15	-	-	-	-
Medium-Density, Gray-Brown And Light Brown, Fine- To Coarse-Grained SAND	38	SS	17	-	-	-	-
	42	SS	19	-	-	-	-
	46	SS	26	-	-	-	-
	50	SS	24	-	-	-	-
	54	SS	24	-	-	-	-

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.

Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

D_d - NATURAL DRY DENSITY - P.C.F.

M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

NA ~~1656~~
311

DRAFT

BORING NO. <u>B-16</u>		BORING LOG (CONTINUATION)		DATE <u>06-27-01</u>			
PROJECT <u>Illinois Power Ash Pond Extension</u>		SHEET <u>34</u> OF <u>34</u>		W. & A. FILE NO. <u>1656</u>			
LOCATION <u>Havana, Illinois</u>							
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q _p	Q _u	D _d	M _c
See Sheet 34 of 34							
	60	SS	23	-	-	-	-
EXPLORATORY BORING DISCONTINUED	64						
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

HA 312

DRAFT

2x2 box culvert under highway / 8
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	2x2 Box Culvert
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.037000 ft/ft
Depth	2.00 ft
Bottom Width	2.00 ft

} FULL FLOW

Results		
Discharge	67.11	cfs
Flow Area	4.00	ft ²
Wetted Perimeter	6.00	ft
Top Width	2.00	ft
Critical Depth	3.27	ft
Critical Slope	0.011496	ft/ft
Velocity	16.78	ft/s
Velocity Head	4.38	ft
Specific Energy	6.38	ft
Froude Number	2.09	
Flow is supercritical.		

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Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666

FlowMaster v5.15
Page 1 of 1

HA 161
313

DRAFT

Check ditch for 1/2 PMP
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Auxiliary Spillway for Havana Polishing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.031
Channel Slope	0.009600 ft/ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V
Bottom Width	10.00 ft
Discharge	100.00 cfs

Results		
Depth	1.33	ft
Flow Area	22.18	ft ²
Wetted Perimeter	23.58	ft
Top Width	23.31	ft
Critical Depth	1.19	ft
Critical Slope	0.014904	ft/ft
Velocity	4.51	ft/s
Velocity Head	0.32	ft
Specific Energy	1.65	ft
Froude Number	0.81	
Flow is subcritical.		

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FlowMaster v5.15
Page 1 of 1

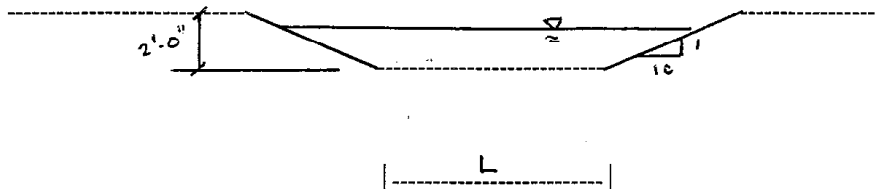
HA 314

DRAFT

Auxiliary Spillway Analysis
Havana Power Station
East Ash Pond #3B

October 8, 2001
JHK

Check auxiliary spillway at the polishing pond for the following new flows of 1/2-PMP storm of 100 cfs and 100-year, 24-hr. storm of 44 cfs. Spillway will act as a weir. Ignore sloping sides when determining capacity of weir.



For the 100 cfs flow, allow H to be up to 1.5'
For the 44 cfs flow, allow H to be up to 1.0'

$$Q = CLH^{1.5} \quad C = 2.70$$

Calculate required width of spillway, L:

$$\text{For } Q = 100 \text{ cfs} \quad L = 100 / [(2.7)(1.5)^{1.5}] = 20.2'$$

$$\text{For } Q = 44 \text{ cfs} \quad L = 44 / [(2.7)(1.0)^{1.5}] = 16.3'$$

Existing spillway is 20'. Note: spillway L does not take into consideration sloping portion of spillway, which would increase the flow going through spillway. Also, these flows assume that effluent pipe is completely blocked, which is unlikely. The auxiliary spillway is not needed to meet the state dam safety criteria.

HA ~~165~~
315

**Auxiliary Spillway Analysis
Havana Power Station
East Ash Pond #3B**

**October 8, 2001
JHK**

The stoplog structure in the polishing pond is both the primary and emergency spillway for the pond system. Calculations elsewhere in this document show that it has sufficient capacity for the maximum design storm.

The auxiliary spillway from the polishing pond is an existing one. As part of this new pond 3B, an additional spillway, connecting pond 3B to the polishing pond, will be added. The critical flow, since both the existing spillway and the new spillway are the same size and dimensions, will come from the existing spillway in the polishing pond where the flow is greater. This calculation checks the existing spillway for the higher discharge resulting from adding a new pond to the system.

The stoplog structure discharges into a 36-inch round reinforced concrete pipe that routes the water to the Illinois River. Should a blockage ever occur in the 36-inch pipe, performance of the stoplog structure would be reduced. To provide for a controlled discharge in the event of a blockage of the 36-inch pipe, an auxiliary spillway was installed in pond #3 as part of the previous pond addition work. There will also be an auxiliary spillway installed between new pond #3B and polishing pond #3, to provide a path for the water should the outlet for pond #3B become blocked.

Since the auxiliary spillway is not the emergency spillway, but is in addition to it, there is no specified design flow. However, since its purpose is to back up the emergency spillway, it is appropriate to use the same design flows for each. As stated above, the existing spillway for polishing pond #3 has the critical water flow. The design flow for the 100-year, 24-hour storm is 44 cfs, and the design flow for the ½-PMP storm is 100 cfs. The auxiliary spillway was analyzed as a broad crested weir. It has a maximum head of 2-feet. The width is sufficient to carry 44 cfs with a 1-ft head and 100 cfs with a 1.5-ft head.

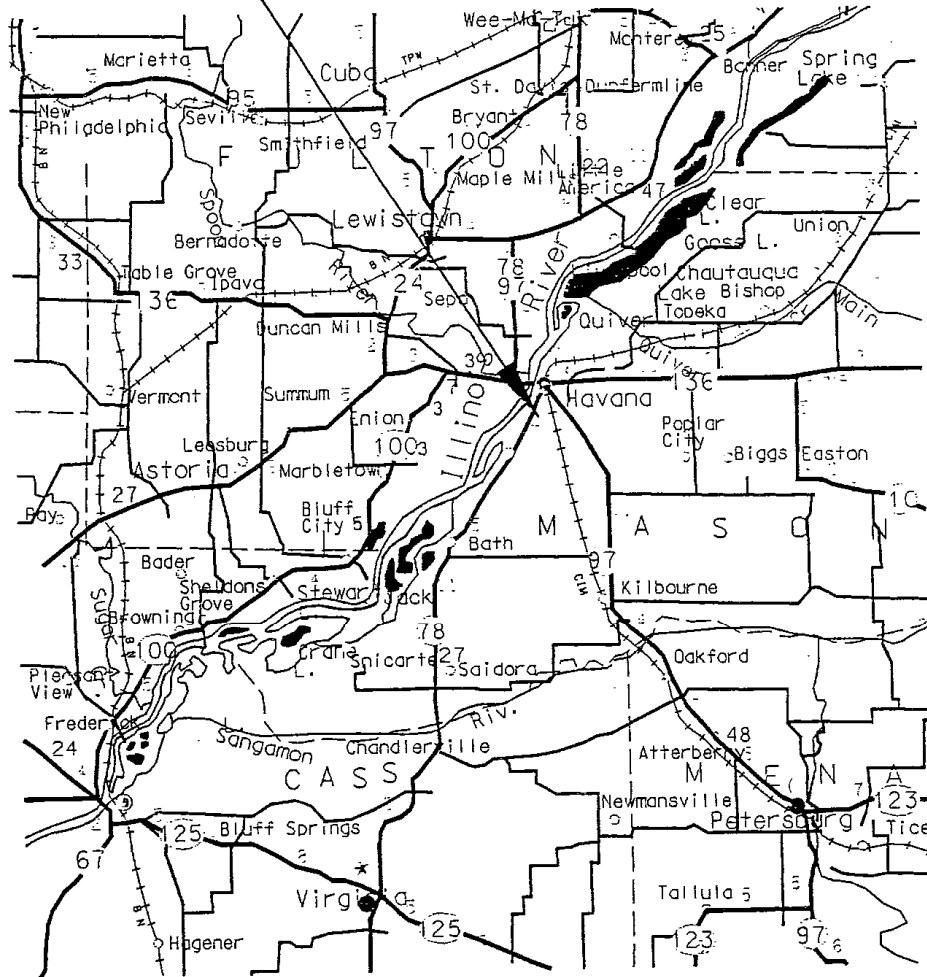
Any water that discharges over the auxiliary spillway from the polishing pond #3 will flow north parallel to Highway 78 to a 2-ft square box culvert located south of the railroad tracks on the north edge of the pond system. The culvert flows westward under the highway, eventually discharging into a large swale draining into the Illinois River. The box culvert will control the maximum flow into the river. It has a full flow capacity of 67 cfs. Flow in excess of this, would cause minor flooding of the highway.

It would be very unlikely that the auxiliary spillway would ever see a discharge. Regular pond observation by the plant would detect high pond levels and corrective action would be taken. Plant flows can be shut down in a short time if critical pond levels are reached.

HA 316

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PROJECT LOCATION



LOCATION MAP

SCALE: 1"=1 MILE

HA ~~506~~
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Response to Request No. 3:

The East Ash Pond System is designed to permanently contain materials in categories (1) fly ash, (2) bottom ash, (3) boiler slag, and (5) other. The category (5) other materials consist discharges to the East Ash Pond System of the following materials as identified in the Havana Power Station's National Pollutant Discharge Elimination System (NDPES) permit:

- Unit 6 bottom ash sluice water
- Unit 6 dry fly ash handling area drainage
- Dredged material
- Units 1-6 demineralizer regenerant wastes
- Unit 6 condensate polisher wastes

The North Ash Pond System is intended to permanently contain materials in categories (1) fly ash, (2) bottom ash, (3) boiler slag, and (5) other. The category (5) other materials consist of discharges to the North Ash Pond System of the following materials as identified in the Havana Power Station's NPDES permit:

- Units 1-6 ash hopper overflow
- Units 1-6 boiler blowdown
- Units 1-6 demineralizer regenerant wastes
- Units 6 condensate polisher wastes
- Units 1-6 floor and sump drainage
- Units 1-5 miscellaneous heat exchangers
- Units 1-5 ash handling equipment drainage
- Unit 6 coal pile runoff
- Unit 6 transformer drains
- Unit 6 roof drainage
- Yard area runoff
- Water softener backwash
- Service water strainer backwash
- Units 1-6 nonchemical metal cleaning waste
- Unit 6 cooling tower blowdown
- Winter low point drain line
- Accumulated coal barge stormwater
- Reverse osmosis unit concentrate
- Reverse osmosis unit maintenance waste
- Activated carbon treatment system effluent
- Groundwater remediation project discharge
- Units 1-6 water sampling system drains

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4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

Response to Request No. 4:

The cells of the East Ash Pond System were designed by and constructed under the supervision of a registered Professional Engineer employed by DMG or the previous owner/operator of Havana Power Station, Illinois Power Company. In 2008 and 2009, a Professional Engineer employed by URS Corporation inspected and assessed the safety of the East Ash Pond System. Prior to that, beginning in approximately 1990 and through 2007, the safety of East Ash Pond System was inspected annually by a registered Professional Engineer employed by DMG or Illinois Power Company.

DMG was unable to locate any records to determine whether the North Ash Pond System was or was not designed by a Professional Engineer. DMG was also unable to locate any records to determine whether the North Ash Pond System was or was not constructed under the supervision of a Professional Engineer. In 2009, a Professional Engineer employed by URS Corporation inspected and assessed the safety of the North Ash Pond System.

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

Response to Request No. 5:

DMG last assessed and evaluated the safety (i.e., structural integrity) of both the North Ash Pond System and the East Ash Pond System in March 2009. The East Ash Pond System was also assessed and evaluated for safety in 2008. Those assessments/evaluations were conducted by Ken Berry, a registered Professional Engineer employed by URS Corporation. Mr. Berry, a Senior Project Manager in the Geotechnical Engineering Group of URS Corporation, is a geotechnical engineer with experience in landslides, levees, foundations,

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geotechnical instrumentation, and general construction. His recent experience includes a design project for the New Orleans levees, a load test on an I-wall and levee in New Orleans, and investigations for 30 miles of levee analyses in the counties east of St. Louis, Missouri. Mr. Berry received his BSCE from North Carolina State University in 1989 and his MSCE (geotechnical) from Virginia Polytechnic Institute and State University in 1990. He is registered as a Professional Engineer in Missouri and Illinois and has been employed by URS Corporation since 1991. Prior to 2008 (i.e., beginning in approximately 1990 and through 2007), a registered Professional Engineer employed by DMG or Illinois Power Company (the previous owner/operator of Havana Power Station) with experience in dam safety annually inspected the safety of the cells of the East Ash Pond System.

DMG has not yet received URS' report of the March 2009 dam inspections at Havana Power Station. After receipt of URS' report, DMG will assign a Professional Engineer to ensure that all required corrective actions are implemented. At that time, DMG will determine whether company employees or contractors will be used to perform any identified corrective actions. DMG has not yet had the opportunity to develop or implement any corrective actions.

DMG plans to have a qualified Professional Engineer perform safety (i.e. structural integrity) inspections of both the East Ash Pond System and North Ash Pond System in 2010.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

Response to Request No. 6:

The IDNR OWR last inspected the safety (structural integrity) of the East Ash Pond System prior to the filling each cell with water. Specifically, IDNR OWR last inspected Cell 1 in 1990; Cells 2 and 4 in 1997, and Cell 3 in 2003. IDNR did not provide and DMG does not have copies of those IDNR inspection reports. DMG is not aware of a planned state or federal inspection or evaluation of the East Ash Pond System in the future.

To the best of DMG's knowledge, no federal or state agency regulatory official has inspected or evaluated the safety (structural integrity) of the North Ash Pond System. DMG is not aware of a planned state or federal inspection or evaluation of the North Ash Pond System in the future.

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7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

Response to Request No. 7:

No federal or state regulatory officials have conducted any assessment, evaluation or inspection of the North Ash Pond System or the East Ash Pond System at Havana Power Station within the past year.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of material currently stored in each of the management unit(s). Please provide the date that the volume measurement was taken. Please provide the maximum height of the management units(s). The basis for determining maximum height is explained later in this Enclosure.

Response to Request No. 8:

The East Ash Pond System has a total surface area of 90 acres. The estimated design storage volume of each cell in the East Ash Pond System at normal pool elevation is as follows: Cell 1 - 520 acre-feet (ac-ft); Cell 2 - 620 ac-ft; Cell 3 - 1,410 ac-ft; and Cell 4 - 75 ac-ft. The total estimated design volume of the East Ash Pond System is 2,625 ac-ft. The estimated volume of materials currently stored in each cell is as follows: Cell 1 - 506 ac-ft; Cell 2 - 565 ac-ft; Cell 3 - 310 ac-ft; and Cell 4 - 7 ac-ft. Because no recent volume measurements have been taken for any of the cells in the East Ash Pond System, on or about March 18, 2009, a DMG-employed Professional Engineer estimated the material volumes in order to respond to this question.

The maximum height of each cell in the East Ash Pond System is approximately as follows: Cell 1 - 25 feet; Cell 2 - 40 feet; Cell 3 - 38 feet; and Cell 4 - 40 feet.

The North Ash Pond System has a surface area of approximately 6 acres. The estimated design storage volume of the North Ash Pond System is 25 ac-ft. The estimated volume of materials currently stored is 5 ac-ft. Because no volume measurements have been taken for the single cell of the North Ash Pond, on or about March 18, 2009, a DMG-employed Professional Engineer estimated the material volumes in order to respond to this question.

The maximum height of the North Ash Pond System is approximately 22 feet.

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9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

Response to Request No. 9:

To the best of DMG's knowledge, there have been no spills or unpermitted releases of coal combustion residues or byproducts to surface water or to the land from either the East Ash Pond System or North Ash Pond System at Havana Power Station in the last ten years.

All discharges from the East Ash Pond System and North Ash Pond System in the last ten years in excess of Havana Power Station's NPDES permit limitations have been reported to the Illinois Environmental Protection Agency, in accordance with NPDES permit reporting requirements. For purposes of responding to this request, DMG did not consider infrequent exceedances of NPDES permit pollutant discharge limits (e.g. TSS) to be "unpermitted releases" within the scope of the EPA's request and, thus, they are not identified in this response. To the extent EPA interprets this request differently, DMG objects to the request because it is vague, overly broad, and too indefinite for reasonable interpretation.

10. Please identify all current legal owner(s) and operator(s) at the facility.

Response to Request No. 10:

Dynegy Midwest Generation, Inc. is the current legal owner and operator of Havana Power Station.

In accordance with and for purposes of the following certification, all portions of this response are hereby identified as information for which the certifying authorized representative cannot personally verify their accuracy.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based

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on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: A. Kirk Millis

Name: A. Kirk Millis

Title: Plant Manager

cc: Rich Eimer, Executive Vice President, Generation Operations
Keith McFarland, Vice President, Midwest Fleet Operations
James Ingram, Vice President & Group General Counsel, Environmental

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Photo 1: (EAPS) Cell 1 Along S Toward Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 2: (EAPS) Cell 1 Looking Toward N of Cell 1 (downstream side), Havana Power Plant, Havana, IL, 05.27.09

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Photo 3: (EAPS) Cell I, Lower Edge of SW Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 4: (EAPS) Cell I SE Corner, Havana Power Plant, Havana, IL, 05.27.09

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Photo 5: (EAPS) Cell 1, SE Toward Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 6: (EAPS) Cell 1, SW Corner, Havana Power Plant, Havana, IL, 05.27.09

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Photo 7: (EAPS) Cell 2, Coal Pile Runoff (mostly storm water), Havana Power Plant, Havana, IL, 05.27.09



Photo 8: (EAPS) Cell 2, NW Corner, Havana Power Plant, Havana, IL, 05.27.09

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Photo 9: (EAPS) Cell 2, NW Corner Looking at Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 10: (EAPS) Cell 2, NW Corner Looking E, Havana Power Plant, Havana, IL, 05.27.09

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Photo 11: (EAPS) Cell 2, NW Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 12: (EAPS) Cell 2 NW Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09

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Photo 13: (Cell 2) NW Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 14: (EAPS) Cell 2, NW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09

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Photo 15: (EAPS) Cell 4, Emergency Spillway (along W edge into roadway; towards plant), Havana Power Plant, Havana, IL, 05.27.09



Photo 16: (EAPS) Cell 4, W Edge (energy dissipater of emergency spillway), Havana Power Plant, Havana, IL, 05.27.09

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Photo 17: (EAPS) Cell 2, Staff Gage, Havana Power Plant, Havana, IL, 05.27.09



Photo 18: (EAPS) Cell 2, N Edge (looking E toward Cell 3 wetting structure), Havana Power Plant, Havana, IL, 05.27.09

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Photo 19: (EAPS) Between Cell 3 and Cell 2 (looking S), Havana Power Plant, Havana, IL, 05.27.09



Photo 20: (EAPS) Cell 3 Extra Fly Ash Basin in SE Corner, Havana Power Plant, Havana, IL, 05.27.09

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Photo 21: (EAPS) Cell 3, Fly Ash Outfall Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 22: (EAPS) Cell 3, Looking N From S Edge, Havana Power Plant, Havana, IL, 05.27.09

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Photo 23: (EAPS) Cell 3, NW Corner (bottom ash outfall area) 1 of 2, Havana Power Plant, Havana, IL, 05.27.09



Photo 24: (EAPS) Cell 3, NW Corner (bottom ash outfall area) 2 of 2, Havana Power Plant, Havana, IL, 05.27.09

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Photo 25: (EAPS) Cell 3, NE Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 26: (EAPS) Cell 3, NE Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09

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Photo 27: (EAPS) Cell 3, NE Corner Looking W (abandoned factory), Havana Power Plant, Havana, IL, 05.27.09



Photo 28: (EAPS) Cell 3, NE Corner Looking W Toward Bottom Ash Discharge Structure, Havana Power Plant, Havana, IL, 05.27.09

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Photo 29: (EAPS) Cell 3, NE Corner Looking NW Toward Barn-Structure (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 30: (EAPS) Cell 3, NE Corner Looking NW Toward Barn-Structure (2 of 2), Havana Power Plant, Havana, IL, 05.27.09

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Photo 31: (EAPS) Cell 3, NW Corner Looking N Toward Barn Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 32: (EAPS) Cell 3, NNW Corner (polypropylene liner), Havana Power Plant, Havana, IL, 05.27.09

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Photo 33: (EAPS) Cell 3, NNW Corner Looking E, Havana Power Plant, Havana, IL, 05.27.09



Photo 34: (EAPS) Cell 3, NNW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09

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Photo 35: (EAPS) Cell 3, NW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 36: (EAPS) Cell 3, NW Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09

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Photo 37: (EAPS) Cell 3, Open Trough Fly Ash Discharge, Havana Power Plant, Havana, IL, 05.27.09



Photo 38: (EAPS) Cell 3, NW Corner Looking SE, Havana Power Plant, Havana, IL, 05.27.09

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Photo 39: (EAPS) Cell 4, Primary Spillway from Cell 4 to River, Havana Power Plant, Havana, IL, 05.27.09



Photo 40: (EAPS) Cell 3, Pipe at SE of Cell 3 (fabrication over synthetic liner), Havana Power Plant, Havana, IL, 05.27.09

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Photo 41: (EAPS) Cell 3, Ponding S of Cell 3 at Toe of Embankment (no flow), Havana Power Plant, Havana, IL, 05.27.09



Photo 42: (EAPS) Cell 3, S Edge Embankment (1 of 3), Havana Power Plant, Havana, IL, 05.27.09

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Photo 43: (EAPS) Cell 3, S Edge Embankment (2 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 44: (EAPS) Cell 3, S Edge Embankment (3 of 3), Havana Power Plant, Havana, IL, 05.27.09

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Photo 45: (EAPS) Cell 3, S Edge Looking E (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 46: (EAPS) Cell 3, S Edge Looking E (2 of 2), Havana Power Plant, Havana, IL, 05.27.09

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Photo 47: (EAPS) Cell 3, E Edge Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 48: (EAPS) Cell 3, S of Cell 3 Area Leading to Ponding, Havana Power Plant, Havana, IL, 05.27.09

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Photo 49: (EAPS) Cell 3, S of Extra Fly Ash Basin, Havana Power Plant, Havana, IL, 05.27.09



Photo 50: (EAPS) Cell 3, SE Corner Looking N (1 of 2), Havana Power Plant, Havana, IL, 05.27.09

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Photo 51: (EAPS) Cell 3, SE Corner Looking N (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 52: (EAPS) Cell 3, SE Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09

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Photo 53: (EAPS) Cell 3, Staff Gage and Primary Spillway, Havana Power Plant, Havana, IL, 05.27.09



Photo 54: (Cell 3) SW Edge Corner (cell 4 to the East/right), Havana Power Plant, Havana, IL, 05.27.09

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Photo 55: (EAPS) From Toe of Cell 3 (NE corner) Looking Toward Adjacent House, Havana Power Plant, Havana, IL, 05.27.09



Photo 56: (EAPS) From Toe of Cell 3 (NE corner) Looking W, Havana Power Plant, Havana, IL, 05.27.09

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Photo 57: (EAPS) Between Cell 3 and Cell 4 Overflow Spillway, Havana Power Plant, Havana, IL, 05.27.09



Photo 58: (EAPS) Cell 3, Vegetation Along S Edge, Havana Power Plant, Havana, IL, 05.27.09

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Photo 59: (EAPS) Cell 3, W Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 60: (EAPS) Cell 4, Intersection of Cell 1 and Cell 4 (NE of Cell 1) Mainly Storm Water, Havana Power Plant, Havana, IL,
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Photo 61: (EAPS) Cell 4, Looking SE at Cell 1, Havana Power Plant, Havana, IL, 05.27.09



Photo 62: (EAPS) Embankment between Cells 3 and 4 Havana Power Plant, Havana, IL, 05.27.09

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Photo 63: (NAPS) Culverts from Coal Pile to NAPS (upstream side), Havana Power Plant, Havana, IL, 05.27.09



Photo 64: (NAPS) Coal Pile Runoff Coming into NAPS, Havana Power Plant, Havana, IL, 05.27.09

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Photo 65: (NAPS) Coal Runoff (culverts connecting two NAPS cells), Havana Power Plant, Havana, IL, 05.27.09



Photo 66: (NAPS) Coal Runoff (culvert connecting two NAPS cells), Havana Power Plant, Havana, IL, 05.27.09

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Photo 67: (NAPS) Into Downstream Pond, Havana Power Plant, Havana, IL, 05.27.09



Photo 68: (NAPS) Wall of Incision, Havana Power Plant, Havana, IL, 05.27.09

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Photo 69: (NAPS) Upstream (plant behind), Havana Power Plant, Havana, IL, 05.27.09



Photo 70: (NAPS) West of NAPS Looking at IL River, Havana Power Plant, Havana, IL, 05.27.09

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Photo 71: (NAPS) Looking S at Incision Wall, Havana Power Plant, Havana, IL, 05.27.09



Photo 72: (NAPS) Culvert Connecting Two Cells, Havana Power Plant, Havana, IL, 05.27.09

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Photo 73: (SAPS) Southernmost Embankment Looking East, Havana Power Plant, Havana, IL, 05.27.09



Photo 74: (SAPS) Looking East Over Capped Cell, Havana Power Plant, Havana, IL, 05.27.09

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Photo 75: (SAPS) Overlooking Closed Pond (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 76: (SAPS) Overlooking Closed Pond (2 of 2), Havana Power Plant, Havana, IL, 05.27.09

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Photo 77: (SAPS) Stop Log Structure (similar design to EAPS), Havana Power Plant, Havana, IL, 05.27.09



Photo 78: (SAPS) Westernmost Embankment Looking S, Havana Power Plant, Havana, IL, 05.27.09

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Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency



Site Name: <u>Havana Power Plant</u>	Date: <u>5/27/09</u>
Unit Name: <u>East Ash Pond System (4 cell)</u>	Operator's Name: <u>Dynegy</u>
Unit I.D.:	Hazard Potential Classification: <u>High</u> Significant Low
Inspector's Name: <u>Cleighton Smith/Lauren Ohotzke</u>	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

Yes No		Yes No	
1. Frequency of Company's Dam Inspections?	<u>Annual</u>	18. Sloughing or bulging on slopes?	<u>X</u>
2. Pool elevation (operator records)?	<u>varies</u>	19. Major erosion or slope deterioration?	<u>X</u>
3. Decant inlet elevation (operator records)?	<u>varies</u>	20. Decant Pipes:	
4. Open channel spillway elevation (operator records)?	<u>N/A</u>	Is water entering inlet, but not exiting outlet?	<u>X</u>
5. Lowest dam crest elevation (operator records)?	<u>Being provided</u>	Is water exiting outlet, but not entering inlet?	<u>X</u>
6. If instrumentation is present, are readings recorded (operator records)?	<u>N/A</u>	Is water exiting outlet flowing clear?	<u>X</u>
7. Is the embankment currently under construction?	<u>X</u>	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	<u>X</u>	From underdrain?	<u>N/A</u>
9. Trees growing on embankment? (if so, indicate largest diameter below)	<u>X</u>	At isolated points on embankment slopes?	<u>N/A</u>
10. Cracks or scarps on crest?	<u>X</u>	At natural hillside in the embankment area?	<u>N/A</u>
11. Is there significant settlement along the crest?	<u>X</u>	Over widespread areas?	<u>N/A</u>
12. Are decant trashracks clear and in place?	<u>N/A</u>	From downstream foundation area?	<u>N/A</u>
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?	<u>X</u>	"Boils" beneath stream or ponded water?	<u>N/A</u>
14. Clogged spillways, groin or diversion ditches?	<u>X</u>	Around the outside of the decant pipe?	<u>N/A</u>
15. Are spillway or ditch linings deteriorated?	<u>X</u>	22. Surface movements in valley bottom or on hillside?	<u>X</u>
16. Are outlets of decant or underdrains blocked?	<u>X</u>	23. Water against downstream toe?	<u>X</u> <u>see notes</u>
17. Cracks or scarps on slopes?	<u>X</u>	24. Were Photos taken during the dam inspection?	<u>X</u>

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
<u>#1</u>	<u>Standing water in areas of toe, but was deemed to be from recent rain.</u>

EPA FORM -XXXX

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U. S. Environmental Protection Agency



Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # _____

INSPECTOR

Cleighton Smith/
Lauren Ohotzke

Date _____

Impoundment Name Havana - East Ash Pond System

Impoundment Company Dynegy

EPA Region IV

State Agency (Field Office) Address Illinois EPA

1021 North Grand Avenue East
PO Box 19276, Springfield, IL 62794-9276

Name of Impoundment East Ash Pond System
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

Is impoundment currently under construction?

Yes

No

Is water or ccw currently being pumped into the impoundment?

X

X

IMPOUNDMENT FUNCTION: storage of ccw

Nearest Downstream Town : Name Havana

Distance from the impoundment less than 1.0 miles

Impoundment

Location: Longitude -90 Degrees 04 Minutes 44.59 Seconds

Latitude 40 Degrees 16 Minutes 36.35 Seconds

State IL County MASON

Does a state agency regulate this impoundment? YES X NO _____

If So Which State Agency? Illinois Dept of Natural Resources
Office of Dam Safety

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

 LESS THAN LOW HAZARD POTENTIAL: Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

 LOW HAZARD POTENTIAL: Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

 SIGNIFICANT HAZARD POTENTIAL: Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

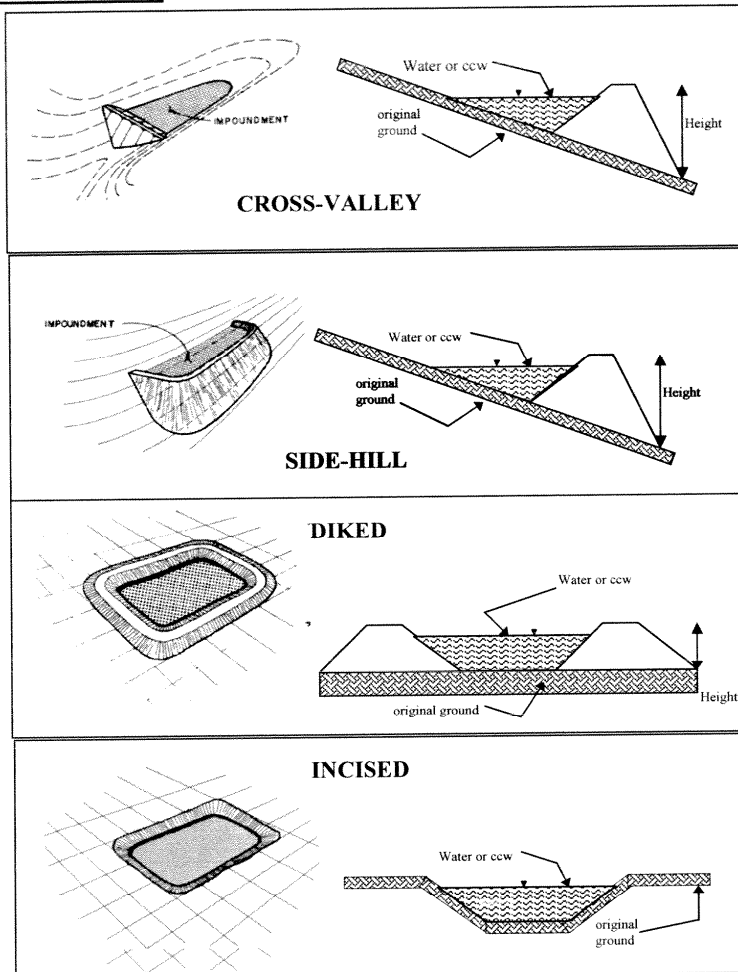
 X **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Homes are located immediately downstream of cell #3. Also IL DNR - Dam Safety has classified this system as high hazard.

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CONFIGURATION:



☐ Cross-Valley

☐ Side-Hill

☒ Diked

☐ Incised (form completion optional)

☐ Combination Incised/Diked

Embankment Height max ~ 40 feet

Pool Area 90 acres

Current Freeboard being provided feet

Embankment Material sand/ash, clay

Liner clay, geo-membrane

Liner Permeability being provided

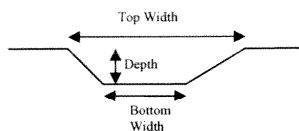
TYPE OF OUTLET (Mark all that apply)

 Open Channel Spillway

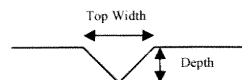
- Trapezoidal
- Triangular
- Rectangular
- Irregular

- depth
- bottom (or average) width
- top width

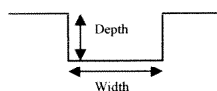
TRAPEZOIDAL



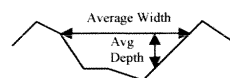
TRIANGULAR



RECTANGULAR



IRREGULAR

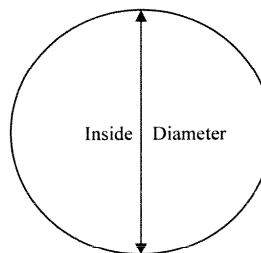


 Outlet

- inside diameter

Material

- corrugated metal
- welded steel
- concrete
- plastic (hdpe, pvc, etc.)
- other (specify) _____



Is water flowing through the outlet? YES NO

 No Outlet

 Other Type of Outlet (specify) DROP STRUCTURE W/ STOP LOGS
- DRAINS TO CULVERT WHICH
DRAINS TO ILLINOIS RIVER - DETAILS BEING PROVIDED
 The Impoundment was Designed By DAVID GASKINS, PE

[illegible]

Has there ever been significant seepages at this site? YES _____ NO X

If So When? N/A

If So Please Describe:

EPA Form XXXX-XXX, Jan 09

6

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO X

If so, which method (e.g., piezometers, gw pumping,...)? N/A

If so Please Describe : _____

EPA Form XXXX-XXX, Jan 09 7

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Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency



Site Name: Havana Power plant Date: 5/27/09
 Unit Name: North Ash Pond system (2 cell) Operator's Name: Dynegy
 Unit I.D.: _____ Hazard Potential Classification: High Significant Low
 Inspector's Name: Cleighton Smith/Lauren Ohotzke

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

SEE NOTE BELOW

Yes No

Yes No

1. Frequency of Company's Dam Inspections?	N/A	18. Sloughing or bulging on slopes?	N/A
2. Pool elevation (operator records)?	N/A	19. Major erosion or slope deterioration?	N/A
3. Decant inlet elevation (operator records)?	N/A	20. Decant Pipes:	
4. Open channel spillway elevation (operator records)?	N/A	Is water entering inlet, but not exiting outlet?	N/A
5. Lowest dam crest elevation (operator records)?	N/A	Is water exiting outlet, but not entering inlet?	N/A
6. If instrumentation is present, are readings recorded (operator records)?	N/A	Is water exiting outlet flowing clear?	N/A
7. Is the embankment currently under construction?	N/A	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	N/A	From underdrain?	N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)	N/A	At isolated points on embankment slopes?	N/A
10. Cracks or scarps on crest?	N/A	At natural hillside in the embankment area?	N/A
11. Is there significant settlement along the crest?	N/A	Over widespread areas?	N/A
12. Are decant trashracks clear and in place?	N/A	From downstream foundation area?	N/A
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?	N/A	"Boils" beneath stream or ponded water?	N/A
14. Clogged spillways, groin or diversion ditches?	N/A	Around the outside of the decant pipe?	N/A
15. Are spillway or ditch linings deteriorated?	N/A	22. Surface movements in valley bottom or on hillside?	N/A
16. Are outlets of decant or underdrains blocked?	N/A	23. Water against downstream toe?	N/A
17. Cracks or scarps on slopes?	N/A	24. Were Photos taken during the dam inspection?	X

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #

Comments

1

THE NORTH ASH POND SYSTEM IS NOT AN IMPOUNDMENT, BUT AN INCISION. ALSO, IT RECEIVES COAL PILE RUNOFF, NOT CCW. ∴ MOST OF CHECKLIST IS NOT APPLICABLE

EPA FORM -XXXX

DRAFT

U. S. Environmental Protection Agency



Coal Combustion Waste (CCW) *N/A*
Impoundment Inspection

Impoundment NPDES Permit # _____
Date _____

INSPECTOR

Cleighten Smith /
Lauren Hotzke

Impoundment Name _____
Impoundment Company _____
EPA Region _____
State Agency (Field Office) Address _____

Name of Impoundment _____
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

Is impoundment currently under construction? _____
Is water or ccw currently being pumped into the impoundment? _____

Yes

No

IMPOUNDMENT FUNCTION: _____

Nearest Downstream Town : Name *Havana*

Distance from the impoundment *less than 1.0 miles*

Impoundment

Location: Longitude *90* Degrees *04* Minutes *44.59* Seconds
Latitude *40* Degrees *16* Minutes *36.35* Seconds
State *IL* County *Mason*

Does a state agency regulate this impoundment? YES _____ NO *X*

If So Which State Agency? _____

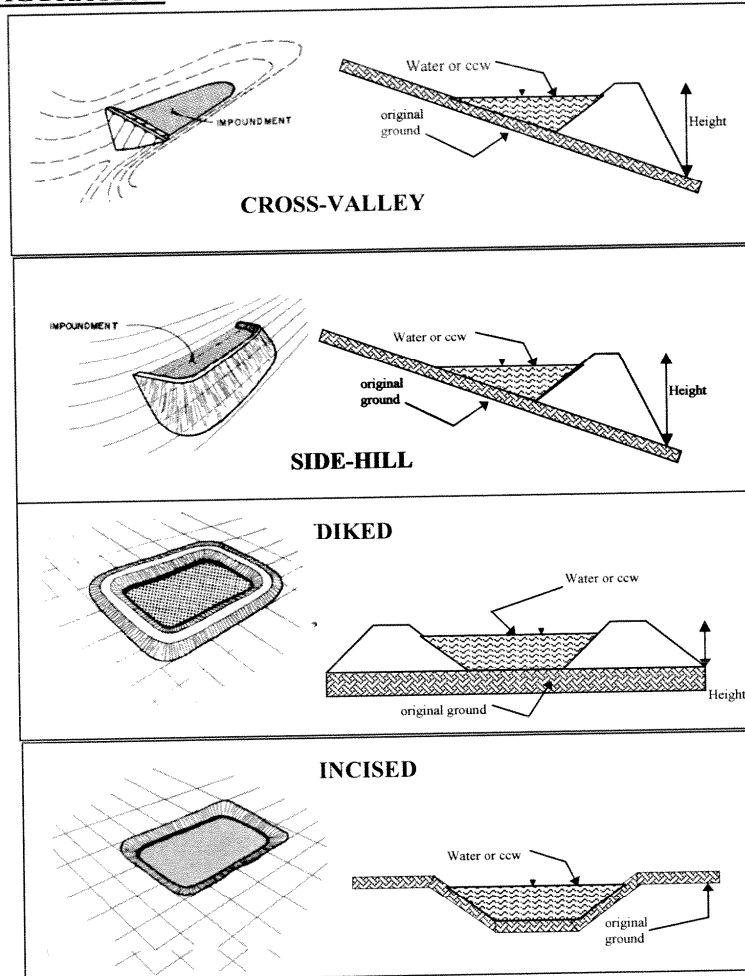
N/A

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

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CONFIGURATION:



☐ Cross-Valley
☐ Side-Hill
☐ Diked
☒ Incised (form completion optional)
☐ Combination Incised/Diked

Embankment Height _____ feet Embankment Material _____
 Pool Area _____ acres Liner _____
 Current Freeboard _____ feet Liner Permeability _____

N/A

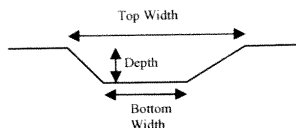
TYPE OF OUTLET (Mark all that apply)

Open Channel Spillway

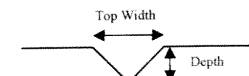
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
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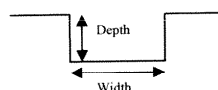
TRAPEZOIDAL



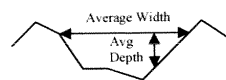
TRIANGULAR



RECTANGULAR



IRREGULAR

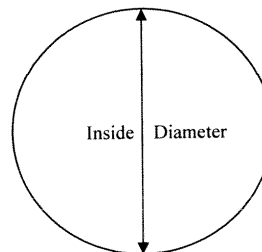


Outlet

- ☐ inside diameter

Material

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify) _____



Is water flowing through the outlet? YES _____ NO _____

No Outlet

Other Type of Outlet (specify) _____

The Impoundment was Designed By _____

DRAFT

N/A

Has there ever been a failure at this site? YES _____ NO _____

If So When? _____

If So Please Describe : _____

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

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N/A

Has there ever been significant seepages at this site? YES _____ NO _____

If So When?

IF So Please Describe: _____

EPA Form XXXX-XXX, Jan 09

6

N/A

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES _____ NO _____

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

EPA Form XXXX-XXX, Jan 09

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Havana Power Plant Site Visit Attendance Sheet

May 27, 2009

Name	Company	Phone	E-mail
Rick Diericx	Dynegy	618-206-5912	Rick.Diericx@Dynegy.com
David Gaskins	Engineering Design Services	217-692-2685	david@eds7.com
Jim Watson	Dynegy-HA	309-543-8777	jim.watson@dynegy.com
Phil Morris	Dynegy	618-206-5934	phil.morris@dynegy.com
Joe Kimlinger	Dynegy	618-410-6534	joe.kimlinger@dynegy.com
Chris Lieberman	IEPA/BOL/Permits	217-524-3294	chris.lieberman@illinois.gov
Ted Dragovich	IEPA	217-524-3306	ted.dragovich@illinois.gov
Doug Van Nattan	IEPA/BOL/Permits	217-524-7505	doug.vannattan@illinois.gov
Ken Berry	URS	314-429-0100	kenneth_berry@URScorp.com
Cleighton Smith	Dewberry	856-802-0843	cleighton.smith@dewberry.com
Lauren Dhotzke	Dewberry	856-802-0843	ldhotzke@dewberry.com

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Havana Power Plant Meeting Notes

May 27, 2009

- Dam Safety Assessment
 - Records, Design Drawings, Calculations, etc.
 - Visual Observation
- Ken (URS) did previous inspection in November
- Almost all drawings of cells done by Dynegy
 - Cleighton reviewed all drawings, placing post-its on those he wanted electronic copies of (Dynegy would be providing those docs)
- Testing done to reach ground water was performed to see if ash is leaking into wells, etc.
- Cells 1, 2, 3, 4 (polishing pond)
- Calculations reviewed
 - Copy of entire calc documents (all done by Dynegy) will be send via PDF to Cleighton
- Breach mapping done to determine speed which would flow out
 - No banks to contain downstream flow so it is difficult to model because the flow could go "anywhere" and "everywhere"
- Height of embankment (max. height) needed for cells in question
 - Reference contour for elevations and slope determination of cell walls (will also be available in calculations)
- Any breach would go right into the Illinois River
- No major housing settlements near "closed" western cell (all along the Illinois River)
- Contact Phil for URS stuff (not Ken, directly)
- ~50% ash sold

Havana Power Plant Site Walk Notes

May 27,

09

- Overall High Hazard
- Plant not operating during our visit due to shut down for construction
- Cells 1, 2, 3, 4 are lined (have an impervious layer)
- Cells on river side are not lined (do not have an impervious layer)
- Culverts are checked daily to insure clear/not clogged
- N. Ash Pond System (NAPS) communicates from 1 side of "road" to the other
- Downstream of (NAPS) looks more like an incision than an impoundment
- No combustion waste maintained (no DNR permits)
- Tertiary cell of NAPS (inactive)
 - All cleaned out
 - No longer takes CCW
 - Only water other than rain water from the dredging of river spoils
- Ash lines running under roadway to cells 1 through 4
 - Lined/covered in a fabric with solid concrete/mortar/grout (no aggregate) pumped into it
- Cell 1 (scalping pond)
 - Mostly closed (over half)
 - Not accepting any new ash
 - Physically, the piping is not hooked up
 - Typically mow top of embankment until where slope makes unsafe for mowers
 - Trees along just beyond top of embankment
 - SE corner= no trees, just grass
 - NE mainly storm water
- Cell 3
 - Some ponding along S edge
 - Extra fly ash basin in SE corner